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CLAIMS

[Claim(s)]

[Claim 1]Portable apparatus which a user can carry.

Body apparatus which performs radio between this portable apparatus.

Are the above the radio equipment which it had and said portable apparatus, When a signal for portable apparatus detection from said body apparatus is received, have a function which transmits a signal of receiving intensity data of the signal for portable apparatus detection to said body apparatus, and said body apparatus, Said signal for portable apparatus detection is transmitted, respectively from two or more body apparatus side antennas arranged at a different position, and it has the function to perform a position judging of said portable apparatus, based on receiving intensity data of said signal for portable apparatus detection for said every body apparatus side antenna which received from said portable apparatus.

[Claim 2]Portable apparatus which a user can carry.

Body apparatus which performs radio between this portable apparatus.

Are the above the radio equipment which it had and said body apparatus, From two or more body apparatus side antennas arranged at a different position, have a function which transmits a signal for portable apparatus detection, respectively, and said portable apparatus, When a signal for portable apparatus detection from said body apparatus is received, respectively, a position judging of the portable apparatus concerned is performed based on receiving intensity data of said signal for portable apparatus detection for said every body apparatus side antenna, and it has a function which transmits a signal as a result of the position judging to said body apparatus.

[Claim 3]Portable apparatus which a user can carry.

Body apparatus which performs radio between this portable apparatus.

Are the above the radio equipment which it had and said portable apparatus, Have a function which transmits a signal for portable apparatus detection, and said body apparatus, It has the function to receive said signal for portable apparatus detection, respectively, and to perform a position judging of said portable apparatus based on receiving intensity data of said portable apparatus detecting signal by each body apparatus side antenna with two or more body apparatus side antennas arranged at a different position.

[Claim 4]Said body apparatus carries out [various] change of the setting out of size relation of a transmission output of said signal for portable apparatus detection from each body apparatus side antenna, The radio equipment according to claim 1 or 2, wherein it has a function which transmits said signal for portable apparatus detection and said body apparatus or portable apparatus performs a position judging of said portable apparatus based on said receiving intensity data obtained about each setting out.

[Claim 5]Said body apparatus carries out [various] change of the setting out of size relation of receiving sensitivity of said signal for portable apparatus detection by each body apparatus side antenna, The radio equipment according to claim 3 characterized by performing a position judging of said portable apparatus based on said receiving intensity data which has the function to receive said signal for portable apparatus detection, and was obtained about each setting out.

[Claim 6]The radio equipment according to any one of claims 1 to 5, wherein said position judging is what judges a position of said portable apparatus in an arrangement direction of an antenna which

makes said pair with size relation of receiving intensity data between antennas which makes a pair among said body apparatus side antennas.

[Claim 7]The radio equipment comprising according to any one of claims 1 to 6:

Said body apparatus is carried in a vehicle and said body apparatus or/and said portable apparatus have said portable apparatus besides a vehicle and in a vehicle based on a result of said position judging.

A user who carried said portable apparatus got in into a vehicle.

A function to judge that said user got down from the inside of a vehicle.

[Claim 8]Said body apparatus is what performs automatically control management for realizing predetermined operation of a controlled object in a vehicle after performing radio between said portable apparatus and carrying out the collation check of being predetermined portable apparatus, The radio equipment according to claim 7 which will be characterized by changing a kind or a control content of said controlled object if it judges that a user who carried said portable apparatus got in into a vehicle.

[Claim 9]Said body apparatus is what performs automatically control management for realizing predetermined operation of a controlled object in a vehicle after performing radio between said portable apparatus and carrying out the collation check of being predetermined portable apparatus, The radio equipment according to claim 7 or 8 if it judges [said body apparatus or/and said portable apparatus] that a user who carried said portable apparatus got in into a vehicle, wherein it will change a transmission output of radio for said collation check in the direction in which grasps decrease in number.

[Claim 10]The radio equipment according to claim 9, wherein, as for a change of said transmission output, prescribed distance is what is changed from a comparatively wide range for remote control including a position outside a vehicle which separated to a limited range limited in a vehicle from a vehicle about grasp of radio for said collation check.

[Claim 11]The radio equipment according to any one of claims 8 to 10, wherein a lock device which performs locking or unlocking of a door of a vehicle is contained in said controlled object and a signal output which realizes a locking action or unlock operation of said lock device is included in said control management.

[Claim 12]The radio equipment according to any one of claims 8 to 11, wherein a mounted object of a vehicle is contained in said controlled object and a signal output to which operation of said mounted object is permitted, data setting operation, or a signal output which orders it operation of said mounted object is included in said control management.

[Claim 13]The radio equipment according to any one of claims 1 to 12, wherein said body apparatus is provided with an antenna which is carried in a vehicle and arranged at a time as a body apparatus side antenna of said plurality in both at least one corner of the getting-on-and-off direction in a vehicle.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the radio equipment which realizes operations (for example, unlock operation of a vehicle door, engine start permission operation, etc.) of the entry system of vehicles, an engine control system, etc., for example without requiring operation [trouble user].

[0002]

[Description of the Prior Art]Conventionally, as a system containing this kind of radio equipment, there is a smart entry system (it is a developed type of a keyless entry system, and passive or called a handsfree entry system etc.) of the vehicles which appeared in recent years, for example. Portable apparatus with which a user can carry this, and body apparatus installed in the controlled object side (in this case, the vehicles side) (in this case) Have a mounted machine, radio performs automatically the collation check of an authorization code (called an ID code or a key code) among these, and it makes for this collated result to be coincidence into a necessary condition, Control of said body apparatus realizes automatically predetermined operation (unlock operation and locking action) of a predetermined controlled object (in this case, lock device of a vehicle door).

[0003]A common keyless entry system, By usually, the thing for which a user operates the specific button etc. which were provided in portable apparatus. Wireless transmission of the specific manipulate signal (for example, unlocking command of a vehicle door) which contains an authorization code from portable apparatus is carried out, After the authorization code by which the body apparatus which received this is contained in the input signal checks supporting the authorization code beforehand set as body apparatus. (Namely, after carrying out a collation check) It is a thing of the composition which performs the predetermined output (for example, control signal output for unlocking of a vehicle door) for controlling a predetermined controlled object, i.e., the one-way-communication type at which only communication of one way from portable apparatus (in this case, transmitter) to body apparatus (in this case, receiver) is performed. On the other hand, a smart entry system in the state where portable apparatus is in grasp to body apparatus (vehicles). for example, by making into a trigger (cause) a certain condition formation (for example, output of the detecting signal of the sensor which detects that the user approached vehicles). When the signal always intermittently sent out from body apparatus is received by portable apparatus, radio (two-way communication) for a collation check is performed automatically, and body apparatus performs automatically control management (for example, unlocking control of the locked vehicle door) according to the situation. In this case, since predetermined operation of a controlled object is realizable even if a user does not do intentional operation at all, it becomes a very high entry system of convenience.

[0004]And in such a system (for example, a smart entry system or the system having the function of keyless entry, and the function of a smart entry). Corresponding to the further improvement in added value of vehicles, or the market demand of convenience or crime prevention disposition superiors, the further multi-functionalization and advancement of a function are demanded and what controls a collation check according two or more controlled objects to radio by the portable apparatus and body apparatus of a lot as a premise is examined. To the physical collation with the conventional key, for example, in addition, the function of what is called an immobilizer system that permits start up of vehicle engine, etc. by making for the collation identification result of the authorization code to have been in agreement into a necessary condition, The system (device controlled after performing a collation check according two or more controlled objects to radio, respectively) having the function of a smart entry system which was mentioned above is demanded. Namely, if the user who carried predetermined

portable apparatus approaches vehicles for example, the lock device of the door of the locked vehicles will be unlocked automatically, If the rear door is opened and it gets in vehicles, the function of an immobilizer system will work automatically, the engine start of the vehicles grants a permission -- having (for example, it will be in the state where an engine starts by the operation of the ignition switch by operation of the usual key) -- the radio equipment it becomes possible to have said is demanded.
[0005]

[Problem(s) to be Solved by the Invention]By the way, in a smart entry system which was mentioned above, after grasping certainly that portable apparatus came outside the car, it must be locked automatically. If a vehicle door is locked when portable apparatus is in in the car, it will be in the so-called state of a yne lock (key file), and inconvenience will arise. Inconvenience, like vehicles suit a theft, without locking it conversely, unless it can grasp certainly that portable apparatus came outside the car arises. In what has a function of the immobilizer system mentioned above. It is desirable to use the authorization code for the lock/unlock of a vehicle door and the authorization code for engine control as another code, and to also change a transmission output from a viewpoint of crime prevention nature, In this case, it is necessary to change the authorization code which judges, transmits and receives that the user who carried portable apparatus got in vehicles, and a transmission output to engine control. for this reason, use any -- in a smart entry system which was mentioned above, it becomes important art to ensure the position judging (judgment of whether portable apparatus is in in the car especially and whether to be outside a car) of portable apparatus.

[0006]However, in the former, since the effective art for ensuring the position judging of portable apparatus was not proposed, realization of the quality smart entry system which can avoid certainly the fault of the yne lock etc. which were mentioned above was difficult. The antenna of body apparatus is formed, for example within and without vehicles, and it is possible by whether communication with portable apparatus was materialized with which antenna to perform the position judging outside in the car of portable apparatus. However, when portable apparatus exists in the delicate position besides in the car in this case, there is a problem that a positive position judging cannot be performed.

[0007]The monitor means which monitors the receiving field intensity of the signal of an authorization code, for example like a statement to JP,11-107592,A is provided in body apparatus, With the size (absolute value) of the receiving field intensity by the body apparatus side [one piece] antenna detected by this monitor means, it is possible to judge the position (distance from said body apparatus side antenna) of portable apparatus. However, in this art, when portable apparatus is near the body apparatus side antenna, that field intensity is saturated, and it does not change, but there is a possibility that that portable apparatus is outside a car cannot judge unless portable apparatus separates from vehicles to some extent. Since the position of portable apparatus can be judged only as a distance from one antenna by the side of body apparatus, an exact position judging is impossible, and when portable apparatus exists in the delicate position besides in the car, there is a problem that a too positive position judging cannot be performed. Then, this invention is radio equipment which consists of portable apparatus which was mentioned above, and body apparatus, and an object of this invention is for the position judging of portable apparatus to provide the radio equipment which becomes possible exactly finely.

[0008]

[Means for Solving the Problem]Radio equipment by invention of the 1st of this application is portable apparatus which a user can carry, and body apparatus which performs radio between this portable apparatus radio equipment which it has, and said portable apparatus, When a signal for portable apparatus detection from said body apparatus is received, have a function which transmits a signal of receiving intensity data of the signal for portable apparatus detection to said body apparatus, and said body apparatus, Said signal for portable apparatus detection is transmitted, respectively from two or more body apparatus side antennas arranged at a different position, and it has the function to perform a position judging of said portable apparatus, based on receiving intensity data of said signal for portable apparatus detection for said every body apparatus side antenna which received from said portable apparatus.

[0009]In this 1st invention, from two or more body apparatus side antennas arranged at a different position, a signal for portable apparatus detection is transmitted, respectively, and a position judging of portable apparatus is performed based on each receiving intensity data by the side of portable apparatus of a signal for these portable apparatus detection. For this reason, even if portable apparatus is near the body apparatus side [one] antenna and receiving intensity patience of a signal for portable

apparatus detection from that body apparatus side antenna carries out **** saturation, a position judging is attained by considerable fineness by change of receiving intensity of a signal for portable apparatus detection from other body apparatus side antennas. That is, a position judging fine and more exact than a case where the number of antennas is one is attained. For example, even when a delicate position of the inside and outside of vehicles in which body apparatus was carried has portable apparatus, a judgment in the car outside of portable apparatus becomes possible exactly. In judging a position of portable apparatus as a distance from the antenna with receiving intensity data in one antenna, Although an absolute position of portable apparatus is not known at all (it understands whether portable apparatus is approaching an antenna), if it is this invention, it is also possible to grasp an absolute position of portable apparatus and to detect a position change of portable apparatus continuously. A signal for a collation check when "a signal for portable apparatus detection" needs a collation check of being predetermined portable apparatus here. Although it functions also as (for example, a request signal which requires a reply of an answer signal which contains an authorization code in portable apparatus), it may be a signal separate from a signal for this collation check. If it is a signal separate from a signal for a collation check, a signal for a collation check of a transmission output of this signal for portable apparatus detection can be set as a separate more desirable value. If a code for a collation check is not contained in a signal for portable apparatus detection, even if it carries out multiple-times transmission of the signal for portable apparatus detection, for example for an exact position judging, there is an advantage which does not pose a crime prevention top problem.

[0010]Radio equipment by invention of the 2nd of this application, Are portable apparatus which a user can carry, and body apparatus which performs radio between this portable apparatus the radio equipment which it has, and said body apparatus, From two or more body apparatus side antennas arranged at a different position, have a function which transmits a signal for portable apparatus detection, respectively, and said portable apparatus, When a signal for portable apparatus detection from said body apparatus is received, respectively, a position judging of the portable apparatus concerned is performed based on receiving intensity data of said signal for portable apparatus detection for said every body apparatus side antenna, and it has a function which transmits a signal as a result of the position judging to said body apparatus. Based on each receiving intensity data of a signal for portable apparatus detection transmitted, respectively, a position judging of portable apparatus is performed from two or more body apparatus side antennas with which this 2nd invention has also been arranged at a different position. For this reason, a position judging of exact fine portable apparatus is attained like the 1st invention. And in this case, since processing of a position judging of portable apparatus is performed by the portable apparatus side, processing by the side of body apparatus becomes easy.

[0011]Radio equipment by invention of the 3rd of this application, Are portable apparatus which a user can carry, and body apparatus which performs radio between this portable apparatus the radio equipment which it has, and said portable apparatus, Have a function which transmits a signal for portable apparatus detection, and said body apparatus, Two or more body apparatus side antennas arranged at a different position receive said signal for portable apparatus detection, respectively, and it has the function to perform a position judging of said portable apparatus, based on receiving intensity data of said portable apparatus detecting signal by each body apparatus side antenna. A signal for a collation check when it needs to be collation checked that "a signal for portable apparatus detection" here is predetermined portable apparatus. Although it functions also as (for example, an answer signal containing an authorization code transmitted to body apparatus from portable apparatus), it may be a signal separate from a signal for this collation check. A position judging of portable apparatus is performed based on each receiving intensity data of a signal for portable apparatus detection received with two or more body apparatus side antennas with which this 3rd invention has also been arranged at a different position. For this reason, a position judging of exact fine portable apparatus is too attained like the 1st invention. And in this case, since processing of a position judging of portable apparatus is performed by the body apparatus side, processing by the side of portable apparatus becomes easy. Since it is necessary to transmit neither a signal of two or more receiving intensity data, nor a signal of a position decision result from portable apparatus, there is an advantage by which a signal which should be transmitted to body apparatus from portable apparatus for a position judging of portable apparatus is simplified.

[0012]As a desirable mode of the 1st or the 2nd invention, Said body apparatus carries out [various] change of the setting out of size relation of a transmission output of said signal for portable apparatus detection from each body apparatus side antenna, It has a function which transmits said signal for

portable apparatus detection, and said body apparatus or portable apparatus is good also as composition which performs a position judging of said portable apparatus based on said receiving intensity data obtained about each setting out. As a desirable mode of the 3rd invention, said body apparatus carries out [various] change of the setting out of size relation of receiving sensitivity of said signal for portable apparatus detection by each body apparatus side antenna. It is good also as composition which performs a position judging of said portable apparatus based on said receiving intensity data which has the function to receive said signal for portable apparatus detection, and was obtained about each setting out. If it does in this way, based on variegated receiving intensity data, a finer position judging or a highly precise position judging will be attained.

[0013]A position of said portable apparatus in an arrangement direction of an antenna where a position judging of portable apparatus makes said pair as a desirable mode of each invention (the 1st thru/or 3rd invention) with size relation of receiving intensity data between antennas which makes a pair among the body apparatus side antennas is judged. Since the above-mentioned position judging is performed based on a communication result (namely, size relation of receiving intensity) unrelated to a transmission output at the time of transmitting and receiving a signal for portable apparatus detection as it is this composition, or an absolute value change and dispersion of receiving sensitivity, without it is influenced by performance changes, such as a communication circuit of portable apparatus or body apparatus, and an antenna, dispersion of performance, etc. — a position judging of always exact portable apparatus — reliability — it becomes it is high and possible. In order to avoid faults, such as saturation of receiving intensity data, for example, A transmission output at the time of transmitting and receiving a signal for portable apparatus detection, or an absolute value of receiving sensitivity, For example, it becomes possible easily to also make it change on the whole according to distance of portable apparatus and each antenna (if portable apparatus is in a long-distance position from each antenna, heighten a transmission output etc., and if portable apparatus is in each antenna at a position of a short distance, make a transmission output etc. low).

[0014]moreover — as the desirable mode of each invention — body apparatus — a vehicle (for example, a car.) It is carried in a motorbike, a light plane, etc. and portable apparatus has body apparatus or/and portable apparatus besides a vehicle and in a vehicle based on a result of said position judging, Or a mode which judges that a user who carried portable apparatus got in into a vehicle, or that said user got down from the inside of a vehicle may be sufficient. In this case, a vehicle inside-and-outside judging of portable apparatus and a getting-on-and-off judging of a user who carried portable apparatus become possible exactly.

[0015]A control machine which performs automatically control management for realizing predetermined operation of a controlled object in a vehicle after body apparatus in each invention was carried in a vehicle, performing radio between portable apparatus and carrying out the collation check of being predetermined portable apparatus (for example) It may be a mounted machine which constitutes the above-mentioned smart entry system. Here, a lock device which performs locking or unlocking of a door of a vehicle, or/and a mounted object (thing except said lock device) of a vehicle are contained in said controlled object, for example. A signal output which realizes a locking action or unlock operation of said lock device or/and a signal output to which operation of said mounted object is permitted, data setting operation, or a signal output which orders it operation of said mounted object is included in said control management, for example. There may be loading apparatus other than driving sources, such as an engine and a motor, such as the controls, such as drives, such as transmission, and a handle, or an audio system, a navigation system or an air-conditioner, in a mounted object of a vehicle. "Data setting operation to which operation of a mounted object is permitted" means internal processing, such as building a flag which permits operation of a mounted object, for example in information processing in body apparatus.

[0016]And when it is a control machine of a vehicle which body apparatus mentioned above and judges that a user who carried portable apparatus by said position judging got in into a vehicle, composition which changes a kind or a control content of a controlled object may be used. For example, in a smart entry system which has an immobilizer function mentioned above. It judges that a user who carried portable apparatus got in vehicles as mentioned already, Although it is desirable to change an authorization code transmitted and received and a transmission output from an object for the lock/unlock of a vehicle door to engine control, a position determining function of this invention may be applied to a getting-on-and-off judging of a user for such mode switching. In this case, the above-mentioned mode switching is carried out exactly and a quality smart entry system can be realized by

extension.

[0017] If it judges that a user to whom body apparatus or/and portable apparatus carried portable apparatus by said position judging got in into a vehicle when it is a control machine of a vehicle which body apparatus mentioned above, A mode which changes a transmission output of radio for said collation check in the direction in which grasps (position range of portable apparatus whose communication to body apparatus is attained) decrease in number is desirable. With such a mode, it is avoided exactly that a signal which contains an authorization code for a collation check although a user who carried portable apparatus is in a vehicle is always broadly transmitted so that it may become ability ready for receiving also around a vehicle, and crime prevention nature (thing to an authorization code theft) falls unnecessarily. Prescribed distance especially grasp of radio for said collation check from a vehicle from a comparatively wide range for remote control including a position outside a vehicle which separated. Crime prevention nature to an authorization code theft can be improved to the maximum extent, a size of grasp always being made into necessary minimum, and securing high convenience, in being what is changed to a limited range limited in a vehicle (the neighborhood of a vehicle may be included).

[0018] There may also be a mode in which both a change of a controlled object etc. which were mentioned above, and a change of a transmission output of radio for a collation check are performed. For example, if it is judged that a user who carried portable apparatus by said position judging got in into a vehicle, while body apparatus will change said controlled object from said lock device to said mounted objects (engine etc.), Composition which changes a transmission output of radio for said collation check may be sufficient as body apparatus or/and portable apparatus so that it may become the limited range in which grasp of radio for said collation check was restricted in a vehicle. A change of the above-mentioned transmission output may follow only the portable apparatus side, may follow only the body apparatus side, and may follow both. A change of said transmission output can be performed by, for example, changing to a value of a transmission output beforehand set to nonvolatile memory etc. for every position range in which portable apparatus exists. Or when changing said transmission output (when load in particular of control management does not pose a problem), it may be made to adjust said transmission output to a necessary minimum value which can communicate preferably each time (in a column of an embodiment of the invention, an example of this output adjustment is explained in full detail).

[0019] As a desirable mode in case body apparatus is what is carried in a vehicle, It is good to have composition provided with an antenna arranged at a time as a body apparatus side antenna in both at least one corner of the getting-on-and-off direction (a crew member aims to get on and off, and it is usually the cross direction right-angled to a direction of movement of a vehicle) in a vehicle. A vehicle inside-and-outside judging of portable apparatus and a judgment of a user's getting-on-and-off operation become possible exactly and easily with relative size relation of receiving intensity data between the body apparatus side antennas arranged to said both corners as it is such composition. For example, for every antenna, in a fixed case, if a transmission output and receiving sensitivity of a signal for portable apparatus detection are a value in which the above-mentioned receiving intensity data is almost equal about both antennas, Portable apparatus and a user can judge that it is in the middle position (center of the inside of a vehicle) of the getting-on-and-off direction, and when one side of the above-mentioned receiving intensity data is a little large, portable apparatus and a user can judge that it is in a position (usually near the door in a vehicle) of antenna slippage of one side of the getting-on-and-off direction. When one side of the above-mentioned receiving intensity data is remarkable and large in this case, portable apparatus and a user can judge that it is in a position (near the door outside a vehicle) besides a vehicle of one side of the getting-on-and-off direction. Therefore, a thing [be / it / that portable apparatus is in a vehicle] etc. which a user who carried portable apparatus got in a vehicle can be judged easily and exactly by a relative comparison of receiving intensity data.

[0020]

[Embodiment of the Invention] Hereafter, an embodiment of the invention is described based on a drawing.

(The example of the 1st gestalt) The example of the 1st gestalt is explained first. This example of a gestalt is an example which applied this invention to the radio equipment of the entry system of the 2 door type vehicles 1, and the engine control system (what has a function of an immobilizer) as showed drawing 1 (b). This device is provided with the following.

As shown in drawing 1 (a), it is the portable apparatus 10.

Body apparatus 20 carried in the vehicles 1.

The antenna 40 for adjustment for transmission output adjustment.

In drawing 1 (a), the numerals 28 and 29, The door opening closed sensor which detects the switching condition of the door of the right and left of the vehicles 1 is shown, and the numerals 31 show the door lock actuator which is a driving source of the door lock device of the vehicles 1, and the numerals 32 show the control unit of the engine control system of the vehicles 1. The above-mentioned door opening closed sensors 28 and 29 are sensors for forming the trigger (cause) of the position judging of portable apparatus, or a transmission output change (adjustment), as later mentioned in this case.

[0021]A receiving means (graphic display abbreviation) for the portable apparatus 10 to receive electric power (Wake rise signal) by the transfer of power of the noncontact type by electromagnetic waves, The portable apparatus side means of communication (what consists of an antenna or a transmission and reception circuit; graphic display abbreviation) for carrying out radio of the signal on different frequency for communication (for example, frequency in a UHF band) from the frequency (for example, 100-200 kHz) of said transfer of power, The received strength measurement means (graphic display abbreviation) which detects the field intensity of the signal received by this portable apparatus side means of communication, The control circuit (graphic display abbreviation) containing the microcomputer (henceforth a microcomputer) which realizes hold stores, such as control management of the whole portable apparatus, and an authorization code, An inside is equipped with an internal battery (graphic display abbreviation), the power supply circuit (graphic display abbreviation) which supplies the electric power of this internal battery to power consumption elements (said portable apparatus side means of communication, a control circuit, etc.), the control circuit (graphic display abbreviation) which performs power control in connection with transfer of power (reception of the Wake rise signal), etc. The switch 11 for locking and the switch 12 (refer to drawing 1 (b)) for unlocking which are the final controlling elements of a push button type are formed in the operation table side of this portable apparatus 10.

[0022]Here, the control circuit of the portable apparatus 10 has the nonvolatile portable apparatus side memory measure (for example, E²PROM; graphic display abbreviation) in which write-in elimination is possible as memory measures, such as an authorization code, for example. A control circuit is a circuit which performs control which changes a control circuit from what is called sleeping (power consumption is a zero state mostly) to a normal state (state which is not sleeping) by making into a trigger electric power (Wake rise signal) received by the receiving means. The change to sleeping from the normal state of a control circuit is realized by a control circuit's own control management in this case. If the switch 11 for locking or the switch 12 for unlocking is operated, naturally a control circuit will shift to a normal state from sleeping if needed, and will receive this operation switch.

[0023]The above-mentioned control circuit of the portable apparatus 10 has the function to perform the following processing operation by operation program setting out of the microcomputer, etc., in a normal state. Namely, as shown in drawing 1 (b), on condition that the request signal by which wireless transmission is carried out from the body apparatus 20 during starting is received, it carries out, It has a function which carries out wireless transmission of the answer signal which contains the thing corresponding to the control mode at the time among two or more authorization codes (the object for door-lock control, engine start and the object for stop control, for output adjustments, etc.) beforehand registered into said portable apparatus side memory measure via the transmission and reception circuit 54. When said portable apparatus side means of communication receives the portable apparatus detecting signal transmitted from the body apparatus 20, It has a function which transmits the portable apparatus detection reply signal containing the receiving intensity data detected by said received strength measurement means, the antenna identification code (it mentions later) contained in the received portable apparatus detecting signal, etc. by said portable apparatus side means of communication (reply). According to the mode switching signal transmitted from the body apparatus 21, control mode is changed from door-lock control mode to engine start and stop control mode, and it has the function to perform output adjustment etc. (the detailed after-mentioned is carried out). Operation of the switch 11 for locking or the switch 12 for unlocking will also have a function which carries out wireless transmission of the locking command signal containing the authorization code for door-lock control, or the unlocking command signal containing the authorization code. If these locking command signal or an unlocking command signal is transmitted and these are received by the body apparatus 20, after a collation check is made by the control facility of the body apparatus 20, operation which locks or unlocks the door of the vehicles 1 will be performed. That is, the radio equipment of this example of a gestalt which consists of the portable apparatus 10 and the body apparatus 20 has the composition of

also realizing the same function as the radio equipment (thing of the one-way-communication type mentioned above) of a common keyless entry system.

[0024]On the other hand, the body apparatus 20 is provided with the following.

As shown in drawing 1 (a), it is the control unit 21.

Vehicle indoor antennas 24 and 25.

In addition to the vehicle indoor antenna, it may be formed in vehicle outdoor instead of the antenna by the side of body apparatus being a vehicle indoor antenna. The vehicle indoor antennas 24 and 25 are formed in right-and-left both the corners (for example, on an instrument panel etc.) of the indoor front part of the vehicles 1 in this case. The antenna 40 for adjustment is formed in the indoor place by the window (a near pillar) of the vehicles 1 to this, for example. Although the vehicle indoor antennas 24 and 25 in this case are shared as an object for transmission and reception of a signal the object for the Wake rise signal transmission (for transfer of power), and usual (for the radio in said frequency for communication), For example, the antenna as an object for transmission and reception of the usual signal and the antenna for transfer of power may be formed separately.

[0025]The control unit 21 is provided with the control circuit 21a containing a microcomputer, the transmission and reception circuit 21b for sending out electric power by transfer of power, or carrying out radio of the signal on the frequency for communication, a power supply circuit, the timer circuit for intermittent starting (graphic display abbreviation), etc. Here, especially since this invention in particular is not limited but various publicly known composition can be adopted at least about the detailed composition of said transmission and reception circuit 21b, a power supply circuit, etc., it does not explain. The control circuit 21a is provided with a microcomputer, and has further the nonvolatile body apparatus side memory measure (for example, E²PROM; graphic display abbreviation) in which write-in elimination is possible as memory measures, such as an authorization code, for example. Power consumption is stopped by necessary minimum by starting this control circuit 21a intermittently with a given period by operation of said timer circuit.

[0026]The above-mentioned control circuit 21a has the function to perform the following processing operation, by operation program setting out of the microcomputer, etc. Namely, whenever it starts, for example by the above-mentioned timer circuit, as it is shown in drawing 1 (b), After sending out the predetermined power which serves as the Wake rise signal of the portable apparatus 10 by the transmission and reception circuit 21b, If wireless transmission of the request signal which searches for an answer signal is carried out by the transmission and reception circuit 21b and the transmission and reception circuit 21b receives said answer signal from the portable apparatus 10 after transmission of this request signal, Noting that a collation check will be made, if it judges whether the authorization code contained in said answer signal supports the authorization code beforehand registered into said body apparatus side memory measure, and this decision result is affirmative, It has the function to perform predetermined control management according to the control mode at the time (the detailed after-mentioned is carried out). The control circuit 21a of the body apparatus 20 is predetermined timing (an example is mentioned later), and performs operation for the position judging of the portable apparatus 10.

[0027]Next, the operation and the principle of a position judging of the portable apparatus 10 in this radio equipment are explained. The position judging of the portable apparatus 10 in this example is performed as follows. First, the portable apparatus detecting signal which contains a respectively separate antenna identification code from either of each vehicle indoor antennas 24 and 25 is transmitted simultaneous or one by one by control of the control circuit 21a of the body apparatus 20, Repeat execution of the communication operation which receives said portable apparatus detection reply signal replied from the portable apparatus 10, respectively is carried out about three conditions (setups of a transmission output). Here, an antenna identification code is the information for identifying whether it is the signal transmitted from any of the antennas 24 and 25. When transmission strength from the antenna 25 of a drivers side (it expresses with the numerals D) is made three conditions with Pt (D) as shown in drawing 2, and transmission strength from the antenna 24 of a passenger side (it expresses with the numerals A) is set to Pt (A), They are the 1st condition used as $Pt(D) > Pt(A)$, the 2nd condition used as $Pt(D) = Pt(A)$, and the 3rd condition used as $Pt(D) < Pt(A)$. At drawing 2, it expresses that it is the 1st condition with the numerals D1 and A1, and expresses that it is the 2nd or 3rd condition with the numerals D2, A2 or D3, and A3 similarly.

[0028]Even if the size as an absolute value of the transmission output of a portable apparatus detecting signal has the portable apparatus 10 in in the car, the receiving intensity data should be set as the value

which is not saturated if possible. It may be made for the position (***** [that it is in distance with each antennas 24 and 25 or in the car] etc.) of the portable apparatus 10 to adjust the absolute value of the transmission output of a portable apparatus detecting signal to a necessary minimum value preferably each time. It adds to the above-mentioned antenna identification code, and condition code is contained in the portable apparatus detecting signal. This condition code is the information for identifying whether it is the signal transmitted on which conditions among the three above-mentioned conditions. On the other hand in the above-mentioned communication operation, in the portable apparatus 10. Whenever it received the portable apparatus detecting signal which is separately transmitted from each antennas 24 and 25, and contains a separate antenna identification code, respectively, as it mentioned above, The portable apparatus detection reply signal containing the receiving intensity data (in this case, absolute value) of each portable apparatus detecting signal, the antenna identification code contained in the received portable apparatus detecting signal, and condition code is transmitted by said portable apparatus side means of communication (reply).

[0029] Then, a total of six receiving intensity data E obtained in this way in the control circuit 21a of the body apparatus 10 (D1). It is judged whether based on E (A1), E (D2), E (A2), E (D3), and E (A3), the portable apparatus 10 exists in which position range of two or more position ranges which can be set in the getting-on-and-off direction (cross direction of the vehicles 1) of the vehicles 1. In this case, as two or more of these position ranges (area), As shown in drawing 2 and drawing 3, the outside of the car of a drivers side, driver door slippage (Dd) (Dout), On drivers side driver's seat central (Dc) drivers side vehicles central slippage (Dcc) and Chuo Line of vehicles, (C), Passenger side vehicles central slippage (Acc), passenger side passenger seat central (Ac) passenger door slippage (Ad), Nine position ranges (Aout) outside the car of a passenger side are set up in the getting-on-and-off direction (cross direction) of the vehicles 1, and it has the composition that a desirable fine position judging is performed by the size relation of each receiving intensity data for the judgment in the car outside of the portable apparatus 10. Namely, if the portable apparatus 10 exists on Chuo Line of vehicles at (C) etc. in the case of the 1st condition ($Pt(D1) > Pt(A1)$), as shown, for example in drawing 2, the size relation of receiving intensity data, It is set to $E(D1) > E(A1)$, if it exists in the center of a passenger side passenger seat (Ac), it will be set to $E(D1) = E(A1)$, and it will be set to $E(D1) < E(A1)$ if it exists in passenger door slippage (Ad) etc. About other conditions, as shown in drawing 2, naturally the size relation of the receiving intensity data about each antenna changes with the existence position ranges of the portable apparatus 10 in a similar manner. then -- if this size relation is classified into the five modes (1-5) as shown in drawing 4 (a) in this case -- about said three conditions in this mode -- combining (mode combination) -- each position range (area) will correspond to 1 to 1, as shown in drawing 4 (b). For this reason, if the mutual comparison of the six obtained receiving intensity data is carried out about a monograph affair, respectively and it asks for the above-mentioned mode combination, the position judging in which the portable apparatus 10 exists from the relation shown in drawing 4 (b) can judge uniquely.

[0030] Next, the example of operation as a system (an entry system and an immobilizer system) of this radio equipment is explained with the control processing contents of the portable apparatus 10 for it, or the body apparatus 20. Drawing 5 is a flow chart which shows the flow of operation of this radio equipment. First, it is judged by processing (processing of the control circuit 21a) of the body apparatus 20 whether control mode is door-lock control mode (Step S1). In the initial state, it is set as door-lock control mode. In [door-lock control mode is the control mode in the case of performing lock/unlock control (control as an entry system) of a door, and] this door-lock control mode, Transmission outputs, such as the transmission and reception circuit 21b of the portable apparatus 10 or the body apparatus 20, serve as a comparatively big initial value (value which realizes comparatively wide grasp for remote control) desirable to an entry system. And when the predetermined power used as the above-mentioned Wake rise signal is sent out from the body apparatus 20 in this door-lock control mode, If the portable apparatus 10 exists in the above-mentioned grasp for remote control and the portable apparatus 10 receives this Wake rise signal, the request signal which the control circuit of the portable apparatus 10 switches from sleeping to a normal state as mentioned above, and is transmitted from the body apparatus 20 after that will also be received by the portable apparatus 10. Then, the answer signal which contains the authorization code for door-lock control (lock/unlock ID code) by processing of the control circuit of the portable apparatus 10 responding to this request signal is transmitted from the portable apparatus 10 (Step S2). Or operation of the switch 11 for locking or the switch 12 for unlocking of the portable apparatus 10 will transmit the locking command signal containing the authorization code for

door-lock control, or the unlocking command signal containing the authorization code by control of the control circuit of the portable apparatus 10 (Step S2). In this case, after transmitting the above-mentioned answer signal, a locking command signal, or an unlocking command signal, the control circuit of the portable apparatus 10 returns to sleeping by own control management, and saves power consumption.

[0031]Then, the answer signal, locking command signal, or unlocking command signal transmitted as mentioned above, If it is transmission out of grasp, and there is no failure of the abnormal drop of the transmission output of the portable apparatus 10, etc., naturally it will be received by the body apparatus 20, It is judged whether the control circuit 21a of the body apparatus 20 which received this answer signal carries out comparative collation of the authorization code for door-lock control memorized by the authorization code for door-lock control contained in the answer signal etc. which were received, and the body apparatus side memory measure, and is in agreement (Step S3). And if the collated result of the above-mentioned authorization code for door-lock control is in agreement, lock/unlock control of the door of the vehicles 1 according to a situation will be performed by control of the control circuit 21a. In this case, when a door specifically has receiving intensity data of the answer signal received, for example in a locked state above a default (when it is presumed that the user has approached the door of the locked vehicles), Or when the received signal is an unlocking command signal, the control signal output which orders the door lock actuator 31 unlock operation is performed. The receiving intensity data of the answer signal received, for example is less than a default (or). When a door is in an unlocked state by the case where it becomes impossible to receive from the state where the answer signal was able to be received (when it is presumed that the user separated from the door of the vehicles of an unlocked state), Or when the received signal is a locking command signal, the control signal output which orders the door lock actuator 31 a locking action is performed (step S4).

[0032]Subsequently, when the lock/unlock control performed by control of the control circuit 21a is a locking action (control signal output which orders it a locking action), a series of operations are ended and operation is repeated from the state of Step S1 (Step S5). When a locking action is performed in this way, When operation of a position judging of the above-mentioned portable apparatus 10 is performed just to make sure, for example and the portable apparatus 10 is in in the car before ending a series of processings, It is good also as composition which outputs an alarm (for example, thing to depend on the operation of a horn, lighting of a light, etc.), or performs unlock operation compulsorily, and avoids a file of the portable apparatus 10 certainly. the time check of the timer with which the control circuit 21a of the body apparatus 20 was beforehand set up on the other hand when the lock/unlock control performed by control of the control circuit 21a was unlock operation (control signal output which orders it unlock operation) — operation is started (Step S6). About several minutes may be sufficient as the set period of this timer. And the control circuit 21a reads the detect output of the door opening closed sensors 28 and 29 after that, If it judges whether the door was able to open or not (Step S7) and what which door was able to open by the time the above-mentioned timer counted up (namely, until the set period of a timer passes since unlock operation) is not judged, Locking control (output of the control signal which orders it a locking action to the door lock actuator 31) is performed, and the door of the vehicles 1 is returned to a locked state (Step S8, S9). Although unlock operation was performed this, since the rear door cannot open, it is operation which is judged to have been unnecessary unlock operation and is automatically returned to a locked state from a viewpoint of crime prevention nature reservation.

[0033]If what the door was able to open by the time the above-mentioned timer counted up is judged, Operation of a position judging of the portable apparatus 10 mentioned above is performed (step S9a), and it is judged exactly whether based on this position decision result, the portable apparatus 10 entered in the empty vehicle outside a vehicle (step S9b). (did the user who carried the portable apparatus 10 get in into the vehicles 1 or not?) For example, when the position of the portable apparatus 10 changes from the area D_{out} mentioned above to D_d and changes to D_c further, it can judge with having entered in the empty vehicle outside a vehicle certainly. In this case, operation (transmission and reception of the portable apparatus detecting signal mentioned above or a portable apparatus detection reply signal, and processing of size comparison of receiving intensity data, etc.) of the above-mentioned position judging, Repeat execution is carried out until it is judged with the vehicle door which it was judged with the portable apparatus 10 having gone into in the car, or was once able to be opened having been closed (step S9b, S9c). When it is judged with the vehicle door having been closed before judging that the portable apparatus 10 went into in the car, it progresses to step S9 from

a viewpoint on crime prevention, and returns to a locked state, and processing of an after that series is ended (step S9c, S9). When the door remains the portable apparatus's 10 having continued existing outside the car, and opening on the occasion of processing of step S9a and S9b, When a predetermined set period passes in the state which the portable apparatus 10 continues existing outside a car, and the door has opened since operation does not progress previously forever (since operation of a position judging will be repeated eternally) for example, it is processing of the control circuit 21a, What is necessary is just to have composition (with the following processing cycles, operation is again repeated from Step S1) which a series of processings end.

[0034]And when it judges that the portable apparatus 10 went into in the car. Since it is presumed that the user who carried the portable apparatus 10 got in into the vehicles 1, the control circuit 21a of the body apparatus 20, While transmitting the mode change reporting signal which reports a mode change after changing control mode to engine start and stop control mode and sending out the Wake rise signal again to the portable apparatus 10, Output switching of the transmission and reception circuit 21b is performed so that it may become a transmission output desirable in this engine start and stop control mode. And it switches from sleeping to a normal state by the above-mentioned Wake rise signal, Output switching of the transmission and reception circuit of the portable apparatus 10 is performed so that the control circuit of the portable apparatus 10 which received the above-mentioned mode change reporting signal may also become a transmission output desirable in this engine start and stop control mode (Step S10, S11). Output switching here is processing which only changes transmission outputs, such as the transmission and reception circuit 21b, into the comparatively small value (for example, value which realizes the vehicle interior of a room and the comparatively narrow communication range (limited range) only around the neighborhood) beforehand set to engine start and stop control modes from an initial value. It is necessary to necessarily change neither the transmission output of the signal for transfer of power (the Wake rise signal in namely, this case), nor the transmission output of the signal for a portable apparatus position judging (a portable apparatus detecting signal and a portable apparatus detection reply signal) among the transmission outputs of the body apparatus 20 or the portable apparatus 10. It is because it is not necessary to not necessarily include an authorization code which poses a crime prevention top problem in these signals. However, it may be made to adjust a transmission output in the reduction direction similarly about the transmission output of a portable apparatus detecting signal from a viewpoint which avoids the saturation of receiving intensity data certainly. For example in front of Step S10 (after step S9b), by processing of the control circuit 21b by the side of the body apparatus 20. It may be made to end a series of operations without performing operation after Step S10, if operation which judges whether the door which was once able to be opened was again shut within the set period is performed and it is not again shut within a set period. Since it generally shuts after opening a door when the user A (shown in drawing 8) gets in into the vehicles 1, it is for making engine start and stop control possible, after checking it.

[0035]Next, as mentioned above, control mode is changed, and it is output adjustment (in this case). If a mere change is performed, the predetermined power used as the above-mentioned Wake rise signal will be again sent out from the body apparatus 20, and the control circuit of the portable apparatus 10 will switch from sleeping to a normal state, When the portable apparatus 10 receives the request signal transmitted from the body apparatus 20 after that, The answer signal which contains engine start and the authorization code for stop control (engine start and stop ID code) by processing of the control circuit of the portable apparatus 10 responding to this request signal is transmitted from the portable apparatus 10 (Step S12). In this case, the control circuit of the portable apparatus 10 returns to sleeping by own control management, for example, after transmitting the above-mentioned answer signal.

[0036]Then, the answer signal transmitted as mentioned above, The control circuit 21a of the body apparatus 20 which was naturally received by the body apparatus 20 when there was no failure of the abnormal drop of the transmission output of the portable apparatus 10, etc., and received this answer signal, Comparative collation of the engine start and the authorization code for stop control memorized by the engine start and the authorization code for stop control contained in the received answer signal, and the body apparatus side memory measure is carried out, and it is judged whether it is in agreement (Step S13). And if the collated result of above-mentioned engine start and authorization code for stop control is in agreement, The signal with which start up and a stop of an engine are permitted to the control unit 32 of an engine control system is outputted by control of the control circuit 21a, and it will be in the state where start up and a stop of an engine were permitted (Step S14). On the other hand, if

the collated result is inharmonious, the signal which forbids start up and a stop of an engine to the control unit 32 of an engine control system will be outputted by control of the control circuit 21a, and it will be maintained by the state where start up and a stop of an engine were forbidden (Step S15). [0037] If start up and a stop of an engine will be permitted, start up and a stop of an engine will be attained by the usual key operation (operation of an ignition key switch). Where start up and a stop of an engine are forbidden, start up and a stop of an engine become impossible only by the usual key operation. The state where start up and a stop of an engine were permitted by Step S14 here, When a door can open and it is shut after that, for example after an engine shutdown from a viewpoint of crime prevention nature reservation. (Namely, when it is presumed that the user got off) Or when judged with the portable apparatus 10 having come outside the car by the judgment of the below-mentioned step S18, it is automatically canceled by control of the control circuit 21a (that is, returned to the state where start up and a stop of an engine were forbidden) — it should constitute like.

[0038] Next, as mentioned above, after becoming engine start and stop control mode, It progresses to Step S16 in the judgment of Step S1 in the following processing cycles, It is judged whether the vehicle door operated (for example, could it open from the state where it closed or not?), In being in the state closed [the state which the vehicle door has opened, or] after becoming engine start and stop control mode, nothing is performed in this case but it completes a series of processings (that is, engine start and stop control mode are maintained). on the other hand, if the vehicle door in the state where it closed, for example can open after becoming engine start and stop control mode, and the vehicle door which remained opening is closed or, the above-mentioned position judging of the portable apparatus 10 will be again performed by making this into a trigger (Step S16, S17). And the portable apparatus 10 came outside the car as a result of this position judging (or). When judged with it being outside a car, the control circuit 21a of the body apparatus 20, While transmitting the mode change reporting signal which reports this mode change after changing control mode from engine start and stop control mode to door-lock control mode and sending out the Wake rise signal to the portable apparatus 10, Output switching of the transmission and reception circuit 21b is performed so that it may become a transmission output desirable to this door-lock control mode (Step S19, S20). And it switches from sleeping to a normal state by the above-mentioned Wake rise signal, Output switching of the transmission and reception circuit of the portable apparatus 10 is performed so that the control circuit of the portable apparatus 10 which received the above-mentioned mode change reporting signal may also become a transmission output desirable to this door-lock control mode (Step S19, S20). When not judged with the portable apparatus 10 having come outside the car as a result of the above-mentioned position judging, operation of a position judging (Step S17) is repeated (namely, when judged with the portable apparatus 10 being in in the car succeedingly). The judgment of whether the portable apparatus 10 in Step S18 came outside the car should be judged more exactly as follows preferably. That is, when the position of the portable apparatus 10 changes from the area Dc mentioned above, for example to Dd and changes to Dout further, it can judge with having come outside the empty vehicle in the car certainly. When [of Step S17 and S18] the portable apparatus 10 is continuing existing in in the car in the case of processing, When a predetermined set period passes in the state where the portable apparatus 10 is continuing existing in in the car since operation does not progress previously forever (since operation of a position judging will be repeated forever) for example, it is processing of the control circuit 21a, a series of processings — ending (operation is again repeated from Step S1) — or Step S12 or subsequent ones should just have composition performed again.

[0039] Without according to the device of this example of a gestalt explained above, a user doing trouble key operation, as shown, for example in drawing 8, After unlocking the door of the vehicles 1 with which the lock/unlock of the door of the vehicles 1 is possible, and was moreover locked by remote control, it becomes handsfree and possible to obtain engine start-up / stop permission. Namely, even if the user A who carried the portable apparatus 10 is separated from the vehicles 1, If it is in said grasp for remote control, by the above-mentioned step S1 — the control action of S4. As shown in drawing 8 (a), automatic unlocking of the door of the vehicles 1 accompanied by the collation check by a smart entry function is performed, or the lock/unlock operation accompanied by the collation check of the door of the vehicles 1 by operation of the switch 11 for locking or the switch 12 for unlocking (in this case, operation needlessness) is attained. If the user A opens a door and gets in in the car as shown in drawing 8 (b) and (c) after the door of the vehicles 1 is unlocked, By the control action of the above-mentioned steps S7–S14, after entrainment operation of the user A by the position judging of the portable apparatus 10 is judged certainly, mode switching is performed, and the function (in this case,

permission of start up and a stop of the engine accompanied by a collation check) as an immobilizer system is performed automatically.

[0040] And when the user A stops the vehicles 1, opens a door like drawing 9 (b) and gets down outside a car after operating the vehicles 1 as shown in drawing 9 (a), by the control action of the above-mentioned steps S16–S20. After alighting operation of the user A by the position judging of the portable apparatus 10 is judged certainly, mode switching is performed, and the function (in this case, automatic lock of the door of the vehicles 1 accompanied by a collation check) as Step S1 – a smart entry system by the control action of S4 is performed automatically again. That is, if it separates from the vehicles 1 as the user A who got down from the vehicles 1 shows drawing 10 (a) and (b), an automatic lock will be realized when communication stopped materializing, for example (at namely, the time of it having become impossible to receive said answer signal).

[0041] By the judgment in the car outside of the portable apparatus 10 in step S9a which mentioned above that the portable apparatus 10 was in in the car – S9b, Steps S17–S18, etc. When it is exactly grasped by the control circuit 21a of the body apparatus 20 and the portable apparatus 10 is in in the car, By the processing of Step S10 or Step S18 mentioned above, since control mode is always maintained by engine start and stop control mode, lock/unlock operation (step S4) of door-lock control mode is not performed certainly. For this reason, it is avoided certainly that it will be in the so-called state of a yne lock (file of the portable apparatus 10) by the locking action by door-lock control mode. If it processes outputting an alarm if position determining operation of the portable apparatus 10 is performed, for example after Step S5 and the comics **** portable apparatus 10 is in in the car just to make sure etc. when a locking action is performed by step S4 as mentioned above, a file of the portable apparatus 10 can be avoided more certainly. Although reference was not made in this example in particular about the case where the locking operation of a vehicle door is made by the usual mechanical key, Also in this case, position determining operation of the portable apparatus 10 is performed by control of the body apparatus 20, and if it processes outputting an alarm if the comics **** portable apparatus 10 is in in the car etc., the file trouble of the portable apparatus 10 by the usual key operation is also avoidable.

[0042] Furthermore, this device by the simple equipment configuration by which the means of communication of the lot was provided in the portable apparatus 10 and the body apparatus 20, respectively. The function (a controlled object is a lock device of the vehicles 1) as an entry system which was mentioned above, Though it is the composition of having realized both functions (a controlled object is an engine control system of the vehicles 1) as an immobilizer system, The change (change of control mode in namely, this case) of the controlled object according to a situation, etc., The desirable grasp according to a controlled object etc. has realized the quality system (smart entry system which has a function of an immobilizer system) which could be realized exactly and always maintained the balance of crime prevention nature and convenience good. Namely, in control actions mentioned above, such as step S9a–S11 and Steps S17–S20, Based on the exact judgment (namely, the user's A judgment in the car outside) in the car outside of the portable apparatus 10, control mode (controlled object) is changed exactly and the change of a transmission output (that is, it responded to the controlled object) according to this control mode is performed further exactly. In this case, in the door-lock control mode which functions as an entry system. It is considered as a comparatively big transmission output (wide grasp), and is considered as a necessary minimum transmission output (narrow grasp) whose communication is attained mostly only indoors in the engine start and stop control mode which functions as an immobilizer system. For this reason, while each functions (the function of a smart entry or the function of an immobilizer) work exactly according to a situation, The transmission output (if it puts in another way grasp) of the portable apparatus 10 in the case of communication of the signal which contains an important authorization code on crime prevention, or the body apparatus 20 is exactly changed to the necessary minimum size which does not spoil convenience, and both convenience and crime prevention nature can always be maintained highly.

[0043] The signal for portable apparatus detection is transmitted, respectively from the body apparatus side antennas 24 and 25 of plurality (in this case, two pieces) arranged in this device at a different position, Based on each receiving intensity data by the side of the portable apparatus of the signal for these portable apparatus detection, as mentioned above, the position judging of the portable apparatus 10 is performed. For this reason, even if the portable apparatus 10 is near the body apparatus side [one] antenna 24 and receiving intensity patience of the signal for portable apparatus detection from that body apparatus side antenna 24 carries out **** saturation, Since the difference in the size

relation of receiving intensity data which was mentioned above appears certainly by change of the receiving intensity of the signal for portable apparatus detection from other body apparatus side antennas 25, Even when the position judging with considerable fineness which was mentioned above becomes certainly possible, for example, the delicate position of the inside and outside of vehicles has the portable apparatus 10, the judgment in the car outside of the portable apparatus 10 becomes possible exactly. In judging the position of the portable apparatus 10 as a distance from the antenna with the receiving intensity data in one antenna, Although the absolute position of the portable apparatus 10 is not known (it understands whether the portable apparatus 10 is approaching the antenna), if it is the position judging art of this example, It is also possible for the absolute position of the getting-on-and-off direction (cross direction) of the vehicles 1 to become clear in this case by the explanation mentioned above in a clear passage, and to detect the position change of the portable apparatus 10 continuously. for this reason, the user who carried the portable apparatus 10 is going to get down from the vehicles 1 — or it becomes easy to judge to only move in the car etc. exactly, and the position of the portable apparatus 10 useful to highly efficient functional realization of a system which was mentioned already, and the information on an action are acquired correctly.

[0044] Since the portable apparatus detecting signal is transmitted and received in this example as a signal separate from especially the signal for a collation check (said request signal and an answer signal), the transmission output of this portable apparatus detecting signal, It is the position judging (in this case) of portable apparatus regardless of the transmission output of the signal for a collation check. Easily, it is possible to set it as a transmission output (for example, value with which it is lower than the transmission output of the request signal in door-lock control mode, and receiving intensity data is not saturated easily) mainly desirable to a vehicle indoor position judging, and by this, It can have composition in which the fault itself called the saturation of receiving intensity data which was mentioned above cannot get up easily. For this reason, the above-mentioned position judging is what has higher reliability also from such a point. In this example, the 1st condition — the 3rd condition of having mentioned above setting out of the size relation of the transmission output of the signal for portable apparatus detection from each body apparatus side antennas 24 and 25 are changed [various], It is the composition which transmits the signal for portable apparatus detection, and the body apparatus 20 is the composition of performing the position judging of the portable apparatus 10 based on the receiving intensity data (in this case, six data) of a large number obtained about each setting out (conditions). For this reason, based on variegated receiving intensity data, the finer position judging or the highly precise position judging is realized. Incidentally in this example, setting out of the size relation of the transmission output of the signal for portable apparatus detection from each body apparatus side antennas 24 and 25, For example, although it is good only also as the 1st above-mentioned condition (setting out with an equal transmission output of each antenna), in this case, For example, it was shown in drawing 2 or drawing 3, about the area D_d , D_c , D_{cc} and A_d , A_c , and A_{cc} , it will be recognized as the same position range, and resolution (delicacy of a position judging) will fall and only that part can judge a motion of the vehicle indoor portable apparatus 10 finely in this case.

[0045] In this example, the position judging of the portable apparatus 10 judges the position of the portable apparatus 10 in the arrangement direction of the antennas 24 and 25 with the size relation of the mutual receiving intensity data of the body apparatus side antennas 24 and 25 which make a pair. For this reason, a communication result unrelated to the transmission output at the time of transmitting and receiving the signal for portable apparatus detection, or the absolute value change and dispersion of receiving sensitivity. since the above-mentioned position judging is performed based on (namely, the size relation of receiving intensity), without it is influenced by performance changes, such as a transmission and reception circuit of the portable apparatus 10 or the body apparatus 20, and an antenna, dispersion of performance, etc. — the position judging of the always exact portable apparatus 10 — reliability — it is high and possible. In order to avoid faults, such as saturation of receiving intensity data, for example, Changing the absolute value of the transmission output at the time of transmitting and receiving the signal for portable apparatus detection on the whole according to the distance of the portable apparatus 10 and each antennas 24 and 25 (for example, if the portable apparatus 10 is outside a car, heighten a transmission output, and if the portable apparatus 10 is in in the car, make a transmission output low) also has an advantage which becomes possible easily. In this example, it has composition which equipped both the corners of the getting-on-and-off direction (in this case, cross direction) in the vehicles 1 with the antennas 24 and 25 arranged an individual every as a body apparatus side antenna (getting it blocked, the arrangement direction of the antennas 24 and 25 is

the getting-on-and-off direction of the vehicles 1). By for this reason, easy processing which compares the relative size relation of the receiving intensity data between each antenna as mentioned above. The whereabouts position of said getting-on-and-off direction of the portable apparatus 10 can judge exactly finely, and the judgment in the car outside of the portable apparatus 10 and the judgment of the user's A getting-on-and-off operation are exactly and easily possible by extension.

[0046]The (example of the 2nd gestalt), next the example of the 2nd gestalt are explained. This example of a gestalt carries out the partial change of the control management of drawing 5 in the example of the 1st gestalt. That is, output adjustment as shown in drawing 6 is performed when changing the output of Step S11 in drawing 5 each time, and the transmission output in engine start and stop control mode is set as each time more desirable value (that is, it adjusts). The art of output adjustment of explaining below may be applied when adjusting the transmission output of the portable apparatus detecting signal mentioned above (other examples of a gestalt mentioned later are the same). In this case, the control circuit of the portable apparatus 10 which received the above-mentioned mode change reporting signal, for example sets first the value of the parameter N for transmission output determination (integer) as "1" (Step S21), and sets the transmission output for adjustment of the transmission and reception circuit of the portable apparatus 10 as "KN" after that (Step S22). Here, "K" is an adjustment unit of a transmission output. Next, in the control circuit of the portable apparatus 10, a transmission output transmits the signal for adjustment in the state of KN (Step S23). Here, the signal for adjustment is a signal which requires the reply of the receiving reporting signal which reports that it can receive, and is good. [of that in which the authorization code (the authorization code for door-lock control, and engine start and the authorization code for stop control) for said collation check is not contained from a viewpoint on a crime prevention disposition] In this case, the authorization code (authorization code for adjustment) separate [for output adjustments] is contained in this signal for adjustment, and it can distinguish now from the signal for adjustment transmitted from other radio equipment of the same type. The body apparatus 20 via the antenna 40 (or the antennas 24 and 25 may be used) for adjustment, If this signal for adjustment is received, the authorization code for adjustment contained in this signal for adjustment will transmit the receiving reporting signal containing the authorization code for adjustment memorized by the body apparatus side memory measure on the assumption that it was in agreement with the authorization code for adjustment memorized by the body apparatus side memory measure by a sufficiently big transmission output.

[0047]Subsequently, the control circuit of the portable apparatus 10 sets the value of the parameter N (integer) as "N+1" (Step S24), and judges whether the receiving reporting signal containing the predetermined authorization code for adjustment was received after that (Step S25). (that is, was the signal for adjustment received by the body apparatus 20 side or not?) And when a predetermined receiving reporting signal is not received, it returns to Step S22 and operation is repeated (that is, only the adjustment unit K makes a transmission output increase further, and transmits the signal for adjustment again, and the above-mentioned judgment is performed again). (namely, when the signal for adjustment is not received by the body apparatus 20 side) On the other hand, when a predetermined receiving reporting signal is received (namely, when the signal for adjustment is received by the body apparatus 20 side), In Step S26, in the case of the radio for a collation check at least. The transmission output of the transmission and reception circuit 21b in (namely, the case of Step S12 of the above-mentioned in this case) is set up in this case "K (N-1)" (that is, a transmission output is made to increase an adjustment unit every K, and it is set as the value which became ability ready for receiving at the beginning).

[0048]According to the above control action, the signal (signal which contains the authorization code for operating a controlled object at least) transmitted from the portable apparatus 10 side is set as a necessary minimum transmission output receivable (the antenna 40 for adjustment, or antennas 24 and 25) by the body apparatus 20 side at the time. For this reason, while not being set as the uniform transmission output (constant value set up beforehand) according to a controlled object, but depending according to a situation, being adjusted to the value of a desirable transmission output each time and securing the reliability of operation of a device highly, the effect that crime prevention nature is improved to the maximum is acquired. In this case, the answer signal (thing containing engine start and the authorization code for stop control) specifically transmitted from the portable apparatus 10 for the engine start and stop authorization control as an immobilizer system, While coming to be certainly received by the body apparatus 20, it is controlled finely that this answer signal is superfluously transmitted to the wide range, and crime prevention nature deteriorates (the grasp which can receive

said answer signal is set as the necessary minimum finer range).

[0049]The body apparatus 20 side may also be made to perform the control action (adjustment of the transmission output in the case of the change of a transmission output) of drawing 6 explained above. Namely, the change (in this case, change in engine start and stop control mode) of control mode, The control circuit 21a judged by formation (in this case, thing which the judgment of Step S7 and S9b became affirmative) of the predetermined trigger, the signal for adjustment being first transmitted in the state of the transmission output KN ($N=1$), and it judging whether this was able to receive with the portable apparatus 10 (or — passing the antenna 40 for adjustment), and, if unreceivable, What is necessary is to make N increase by "1" every, to repeat transmission of the signal for adjustment, and just to set the transmission output used by communication of Step S12 as the value of a transmission output when it is able to receive to the beginning in the place received first. The request signal which will be transmitted from the body apparatus 20 for the engine start and stop authorization control as an immobilizer system if it does in this way (by a case.) While coming to be certainly received by the portable apparatus 10, the thing containing the authorization code for a request for distinction with other devices, It is controlled finely that this request signal is superfluously transmitted to the wide range, and crime prevention nature deteriorates (the grasp which can receive said request signal is set as the necessary minimum finer range). When the above-mentioned transmission output adjustment is especially performed based on the communication propriety result of the signal for adjustment over the antenna 40 for adjustment, the grasp (namely, the ready-for-receiving ability range of the portable apparatus 10) of the signal transmitted to the portable apparatus 10 from the body apparatus 22 is set as the vehicle indoor last minute of the vehicles 1. for this reason, the function which communication of will certainly be attained and an immobilizer system will carry out if the portable apparatus 10 is in the vehicle interior of a room — enough — convenience — it being able to utilize highly and, And since the signal (in this case, request signal) transmitted from the body apparatus 20 hardly leaks to vehicle outdoor, the crime prevention nature to the theft of a request signal increases to the maximum. Although it is not directly linked with the theft of vehicles, since an answer signal can be made to output from the portable apparatus 10 using this request signal now, the theft of a request signal has the desirable composition in which a request signal cannot carry out a theft easily from a viewpoint of securing high crime prevention nature, either.

[0050]The (example of the 3rd gestalt), next the example of the 3rd gestalt are explained. This example of a gestalt also carries out the partial change of the control management of drawing 5 in the example of the 1st gestalt. That is, output adjustment as shown in drawing 7 is performed when changing the output of Step S11 in drawing 5 each time, and the transmission output in engine start and stop control mode is set as each time more desirable value. In this case, the control circuit of the portable apparatus 10 which received the above-mentioned mode change reporting signal, for example sets first the value of the parameter N for transmission output determination (integer) as "10" (Step S31), and sets the transmission output for adjustment of the transmission and reception circuit of the portable apparatus 10 as "KN" after that (Step S32). Next, in the control circuit of the portable apparatus 10, a transmission output transmits the signal for adjustment in the state of KN (Step S33).

[0051]Subsequently, it is judged whether the control circuit 55 received the receiving reporting signal containing the predetermined authorization code for adjustment (Step S34). (that is, was the signal for adjustment received by the body apparatus 20 side or not?) And when a predetermined receiving reporting signal is received (namely, when the signal for adjustment is received by the body apparatus 20 side). The value of the parameter N (integer) is set as "N-2" (Step S35), it returns to Step S32 after that, and operation is repeated (that is, a transmission output is decreased by the twice of the adjustment unit K, the signal for adjustment is transmitted again, and the above-mentioned judgment is performed again). On the other hand, when a predetermined receiving reporting signal is not received (namely, when the signal for adjustment is not received by the body apparatus 20 side), In Step S36, in the case of the radio for a collation check at least. Temporary setting of the transmission output of the transmission and reception circuit 21b in (namely, the case of Step S12 of the above-mentioned in this case) is carried out to "K (N+1)" (that is, temporary setting is carried out to a value only with the bigger adjustment unit K than the value of the adjustment unit K decreased the transmission output every 2 times and it became impossible to receive first). Subsequently, the signal for adjustment is again transmitted by setting out of the transmission output by this step S36 (Step S37). And when the receiving reporting signal containing the predetermined authorization code for adjustment is received, the last setting out of the transmission output of the transmission and reception circuit 21b in the case

of the radio for a collation check is carried out at least at "K (N+1)" (Step S38, S39). (namely, when the signal for adjustment for the second time is received by the body apparatus 20 side) On the other hand, when a predetermined receiving reporting signal is not received, the last setting out of the transmission output of the transmission and reception circuit 21b in the case of the radio for a collation check is carried out at least at "K (N+2)" (Step S38, S40). (namely, when the signal for adjustment for the second time is not received by the body apparatus 20 side)

[0052]The signal transmitted from the portable apparatus 10 side by the above control action at the time (at least) While setting the signal containing an authorization code as a necessary minimum transmission output receivable by the body apparatus 20 side, depending according to a situation, being adjusted to the value of a desirable transmission output and securing the reliability of operation of a device highly, the effect that crime prevention nature is improved to the maximum is acquired. Characteristic one enlarges variation width of a transmission output at first in this example of the 3rd gestalt (that is, in this case). 2 — when the communication to the beginning becomes making it change every [K] and impossible, radio for adjustment is performed again, and according to that result, the transmission output is finely tuned with still smaller variation width (in this case, K) (Steps S37–S40). For this reason, compared with the case (in the case like said example of the 2nd gestalt) where change a transmission output little by little and it is adjusted with the minimum variation width, there is an advantage in which time required for adjustment is short and lives. The body apparatus 20 side may be made to perform the control action (example of another of adjustment of the transmission output in the case of the change of a transmission output) of drawing 7 explained above similarly.

[0053](Other examples of a gestalt) In addition, this invention is not limited to the above-mentioned example of a gestalt, and may have various kinds of modification and a mode. First, in the above-mentioned example of a gestalt, as mentioned above, the relative comparison (size comparison) of the receiving intensity data of the portable apparatus detecting signal about each antennas 24 and 25 is performing the position judging of the portable apparatus 10, but it is also possible to perform a position judging based on the absolute value of these receiving intensity data. Namely, based on the absolute value of each receiving intensity data, the distance from each antennas 24 and 25 to the portable apparatus 10 is judged, The composition of judging the absolute value on the level surface of the portable apparatus 10 by pinpointing the position on the level surface by which these two distance conditions are fulfilled (on a flat surface parallel to a road surface) on the basis of the position of each antennas 24 and 25 may be used.

[0054]In the above-mentioned example of a gestalt, as a portable apparatus detection reply signal replied from the portable apparatus 20, the value of receiving intensity data is considered as the composition which transmits the present state, and the position judging of the portable apparatus 10 based on the value of this receiving intensity data is processed by the body apparatus 10 side. However, comparison test processing (refer to drawing 2) of the size relation of the receiving intensity data mentioned above, for example, The data of the position decision result of the portable apparatus 10 based on [carry out by the portable apparatus 10 side and] this comparison test processing. The mode as which the portable apparatus 10 answers the portable apparatus detection reply signal containing (for example, the data of the mode connection shown in drawing 4 or the data in which the area itself in which the portable apparatus 10 is located is shown) to the body apparatus 20 may be sufficient.

[0055]The composition realized by the following processings may be used for the position judging of the portable apparatus 20. Corresponding [namely,] to the request signal for the portable apparatus detection from the body apparatus 20 for example, From the portable apparatus 10 side, have composition which transmits a portable apparatus detecting signal, and the body apparatus 20, The mode which receives said portable apparatus detecting signal from the portable apparatus 10, respectively, and performs the position judging of the portable apparatus 10 similarly based on the receiving intensity data of said portable apparatus detecting signal by each body apparatus side antennas 24 and 25 with the body apparatus side antennas 24 and 25 arranged at a different position may be sufficient. In this case, for example, it is made to transmit the signal for portable apparatus detection from the portable apparatus 10 3 times, They are three conditions (when the receiving sensitivity by each antenna is equal) about setting out of the receiving sensitivity by the body apparatus side antennas 24 and 25. By changing and receiving on three conditions when the receiving sensitivity by the antenna of another side is larger, when the receiving sensitivity by one antenna is larger. The operation effect (fine position judging) same with setting up the transmission output of the signal for portable apparatus detection on three conditions in said example of a gestalt is obtained.

[0056] Although the one-dimensional absolute position of the portable apparatus 10 is judged with two antennas in the above-mentioned example of a gestalt, Furthermore, many antennas are arranged in a different position, and if decision processing same about every two antennas of both that make a pair is performed, the judgment of a two-dimensional absolute position and a still finer position judging will be attained (for example, the position judging of the direction of movement of vehicles is also possible). In order to raise the resolution of a position judging, the conditions of the transmission output mentioned above or receiving sensitivity may be set up finely still in large numbers. Although the above-mentioned example of a gestalt showed the example for which the portable apparatus 10 or body apparatus 20 side also performs the change of a transmission output according to the change of the controlled object, the mode of which either one of the portable apparatus 10 side or the body apparatus 20 side smells, for example and which performs the change of a transmission output like a lever may be sufficient. Since the signal which incidentally includes the information on the most important authorization code in the case of the above-mentioned example of a gestalt is an answer signal transmitted from the portable apparatus 10 side, a practical effect is large even if it changes only the transmission output of the answer signal of the portable apparatus 10 by a controlled object. Although the signal (signal for adjustment) transmitted and received by the radio for adjustment shall contain the authorization code for adjustment in the above-mentioned example of a gestalt, it is good also as composition which does not perform the collation check from a viewpoint of the improvement in a process speed of output adjustment excluding such an authorization code, either.

[0057] Although the above-mentioned example of a gestalt showed the example which performs separately processing of the output adjustment shown in drawing 6, drawing 7, etc. by the portable apparatus 10 and body apparatus 20 side, For example, it may perform only by the body apparatus 20 side, the signal which reports the adjustment result may be transmitted to the portable apparatus 10, and the composition (for example, composition which does not transmit the signal for adjustment for output adjustment in the portable apparatus 10 side) that a transmission output is changed into the value according to the signal may be used in the portable apparatus 10 side. Although the composition which communicates by changing the control circuit of the portable apparatus 10 from sleeping to a normal state suitably with the Wake rise signal by transfer of power was illustrated in the above-mentioned example of a gestalt, the control circuit of the portable apparatus 10 may be the composition only intermittently started by operation of a timer circuit (graphic display abbreviation). In this case, transmission of said Wake rise signal becomes unnecessary. This invention may not have a function of a common keyless entry system (in this case, the switches 11 and 12 are unnecessary).

[0058] Although the case where the number of controlled objects was two (the lock device and engine control system of a vehicle door) was illustrated in the above-mentioned example of a gestalt, further two or more controlled objects may exist. Although the trigger used as the cause which performs the position judging of the portable apparatus 10 and changes a controlled object and a transmission output is considered as the operation of the door in the above-mentioned example of a gestalt, it cannot be overemphasized that it is not restricted to this, either. For example, in making the lock device of a vehicle door, and engine start and a stop control system into a controlled object like the above-mentioned example of a gestalt. For example, when the doorknob sensor which detects that the hand etc. of the doorknob operation sensor which detects that the user operated the doorknob, or the user contacted or approached the doorknob is formed and these sensors output a detecting signal, As long as it is judged that performed the position judging of the portable apparatus 10 and the portable apparatus 10 went into in the car, it may be the composition that switch to engine start and stop control Mohd, and the change (change to the transmission output for start up and stop control Mohd) of a transmission output according to it is performed.

[0059] Although the above-mentioned example of a gestalt gave and explained the example in case the Wake rise signal (or request signal) is transmitted intermittently from the body apparatus side, It is good also as first composition for the Wake rise signal and a request signal to be transmitted from a viewpoint of cutting down the power consumption by the side of body apparatus, when a certain trigger is materialized. For example, when said doorknob operation sensor or a doorknob sensor outputs a detecting signal, the composition that the Wake rise signal (or request signal) is transmitted, and lock/unlock control is performed for the first time may be used. When position determining operation of the portable apparatus 10 is performed only when it is presumed in the above-mentioned example of a gestalt that the user is getting on and off to vehicles, a user gets in vehicles or it is judged with the user having got down from vehicles, Or when the predetermined set period expires, he is trying to suspend

the position determining operation of the portable apparatus 10. However, it may be made to perform position determining operation of the portable apparatus 10 continuously for a long time. For example, from the time of the user who is carrying the portable apparatus 10 opening a door, and getting in in the car. Until an engine actually starts, or until the rear door is shut and a locking action is performed, Or repeat execution of the position determining operation is carried out continuously, the position of the portable apparatus 10 (namely, user) is grasped continuously, and it may be made to use for control of a system until the position of the portable apparatus 10 stops changing after that.

[0060]It is as description in the column of The means for solving a technical problem that this invention is restricted to neither unlocking or locking of a door, nor engine start up, but there may be various kinds of controlled objects and control contents. Even if it is the same controlled object, a control content and a transmission output may be changed according to the position decision result of portable apparatus. Further two or more switches may be formed in the portable apparatus 10, and it may have composition in which various kinds of remote control (manual operation) is possible corresponding to this. For example, the switch for operating opening and closing of a suitcase, an engine room or a refueling mouth, etc., etc. by remote control, when it is attacked by the rowdy, it cannot be overemphasized that the panic switch for blowing the horn of vehicles, etc. may be formed suitably. This invention is widely [besides the entry system of vehicles, etc.] applicable, if it is a device which performs a certain control based on the radio between portable apparatus and body apparatus.

[0061]

[Effect of the Invention]According to the radio equipment of this invention, the position judging of portable apparatus is performed based on the receiving intensity data of the signal for portable apparatus detection by two or more body apparatus side antennas arranged at a different position. For this reason, even if portable apparatus is near the body apparatus side [one] antenna and receiving intensity patience of the signal for portable apparatus detection by that body apparatus side antenna carries out **** saturation, a position judging is attained by considerable fineness by change of the receiving intensity of the signal for portable apparatus detection by other body apparatus side antennas. That is, a position judging fine and more exact than the case where the number of antennas is one is attained. For example, even when the delicate position of the inside and outside of vehicles in which body apparatus was carried has portable apparatus, the judgment in the car outside of portable apparatus becomes possible exactly. In judging the position of portable apparatus as a distance from the antenna with the receiving intensity data in one antenna, Although the absolute position of portable apparatus is not known at all (it understands whether portable apparatus is approaching the antenna), if it is this invention, it is also possible to grasp the absolute position of portable apparatus and to detect the position change of portable apparatus continuously.

[Translation done.]

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TECHNICAL FIELD

[Field of the Invention]This invention relates to the radio equipment which realizes operations (for example, unlock operation of a vehicle door, engine start permission operation, etc.) of the entry system of vehicles, an engine control system, etc., for example without requiring operation [trouble user].

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PRIOR ART

[Description of the Prior Art]Conventionally, as a system containing this kind of radio equipment, there is a smart entry system (it is a developed type of a keyless entry system, and passive or called a handsfree entry system etc.) of the vehicles which appeared in recent years, for example. Portable apparatus with which a user can carry this, and body apparatus installed in the controlled object side (in this case, the vehicles side) (in this case) Have a mounted machine, radio performs automatically the collation check of an authorization code (called an ID code or a key code) among these, and it makes for this collated result to be coincidence into a necessary condition, Control of said body apparatus realizes automatically predetermined operation (unlock operation and locking action) of a predetermined controlled object (in this case, lock device of a vehicle door).

[0003]A common keyless entry system, By usually, the thing for which a user operates the specific button etc. which were provided in portable apparatus. Wireless transmission of the specific manipulate signal (for example, unlocking command of a vehicle door) which contains an authorization code from portable apparatus is carried out, After the authorization code by which the body apparatus which received this is contained in the input signal checks supporting the authorization code beforehand set as body apparatus. (Namely, after carrying out a collation check) It is a thing of the composition which performs the predetermined output (for example, control signal output for unlocking of a vehicle door) for controlling a predetermined controlled object, i.e., the one-way-communication type at which only communication of one way from portable apparatus (in this case, transmitter) to body apparatus (in this case, receiver) is performed. On the other hand, a smart entry system in the state where portable apparatus is in grasp to body apparatus (vehicles). for example, by making into a trigger (cause) a certain condition formation (for example, output of the detecting signal of the sensor which detects that the user approached vehicles). When the signal always intermittently sent out from body apparatus is received by portable apparatus, radio (two-way communication) for a collation check is performed automatically, and body apparatus performs automatically control management (for example, unlocking control of the locked vehicle door) according to the situation. In this case, since predetermined operation of a controlled object is realizable even if a user does not do intentional operation at all, it becomes a very high entry system of convenience.

[0004]And in such a system (for example, a smart entry system or the system having the function of keyless entry, and the function of a smart entry). Corresponding to the further improvement in added value of vehicles, or the market demand of convenience or crime prevention disposition superiors, the further multi-functionalization and advancement of a function are demanded and what controls a collation check according two or more controlled objects to radio by the portable apparatus and body apparatus of a lot as a premise is examined. To the physical collation with the conventional key, for example, in addition, the function of what is called an immobilizer system that permits start up of vehicle engine, etc. by making for the collation identification result of the authorization code to have been in agreement into a necessary condition, The system (device controlled after performing a collation check according two or more controlled objects to radio, respectively) having the function of a smart entry system which was mentioned above is demanded. Namely, if the user who carried predetermined portable apparatus approaches vehicles for example, the lock device of the door of the locked vehicles will be unlocked automatically, If the rear door is opened and it gets in vehicles, the function of an immobilizer system will work automatically, the engine start of the vehicles grants a permission -- having (for example, it will be in the state where an engine starts by the operation of the ignition switch by operation of the usual key) -- the radio equipment it becomes possible to have said is demanded.

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EFFECT OF THE INVENTION

[Effect of the Invention]According to the radio equipment of this invention, the position judging of portable apparatus is performed based on the receiving intensity data of the signal for portable apparatus detection by two or more body apparatus side antennas arranged at a different position. For this reason, even if portable apparatus is near the body apparatus side [one] antenna and receiving intensity patience of the signal for portable apparatus detection by that body apparatus side antenna carries out **** saturation, a position judging is attained by considerable fineness by change of the receiving intensity of the signal for portable apparatus detection by other body apparatus side antennas. That is, a position judging fine and more exact than the case where the number of antennas is one is attained. For example, even when the delicate position of the inside and outside of vehicles in which body apparatus was carried has portable apparatus, the judgment in the car outside of portable apparatus becomes possible exactly. In judging the position of portable apparatus as a distance from the antenna with the receiving intensity data in one antenna, Although the absolute position of portable apparatus is not known at all (it understands whether portable apparatus is approaching the antenna), if it is this invention, it is also possible to grasp the absolute position of portable apparatus and to detect the position change of portable apparatus continuously.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]By the way, in a smart entry system which was mentioned above, after grasping certainly that portable apparatus came outside the car, it must be locked automatically. If a vehicle door is locked when portable apparatus is in the car, it will be in the so-called state of a yne lock (key file), and inconvenience will arise. Inconvenience, like vehicles suit a theft, without locking it conversely, unless it can grasp certainly that portable apparatus came outside the car arises. In what has a function of the immobilizer system mentioned above. It is desirable to use the authorization code for the lock/unlock of a vehicle door and the authorization code for engine control as another code, and to also change a transmission output from a viewpoint of crime prevention nature. In this case, it is necessary to change the authorization code which judges, transmits and receives that the user who carried portable apparatus got in vehicles, and a transmission output to engine control. for this reason, use any — in a smart entry system which was mentioned above, it becomes important art to ensure the position judging (judgment of whether portable apparatus is in in the car especially and whether to be outside a car) of portable apparatus.

[0006]However, in the former, since the effective art for ensuring the position judging of portable apparatus was not proposed, realization of the quality smart entry system which can avoid certainly the fault of the yne lock etc. which were mentioned above was difficult. The antenna of body apparatus is formed, for example within and without vehicles, and it is possible by whether communication with portable apparatus was materialized with which antenna to perform the position judging outside in the car of portable apparatus. However, when portable apparatus exists in the delicate position besides in the car in this case, there is a problem that a positive position judging cannot be performed.

[0007]The monitor means which monitors the receiving field intensity of the signal of an authorization code, for example like a statement to JP,11-107592,A is provided in body apparatus; With the size (absolute value) of the receiving field intensity by the body apparatus side [one piece] antenna detected by this monitor means, it is possible to judge the position (distance from said body apparatus side antenna) of portable apparatus. However, in this art, when portable apparatus is near the body apparatus side antenna, that field intensity is saturated, and it does not change, but there is a possibility that that portable apparatus is outside a car cannot judge unless portable apparatus separates from vehicles to some extent. Since the position of portable apparatus can be judged only as a distance from one antenna by the side of body apparatus, an exact position judging is impossible, and when portable apparatus exists in the delicate position besides in the car, there is a problem that a too positive position judging cannot be performed. Then, this invention is radio equipment which consists of portable apparatus which was mentioned above, and body apparatus, and an object of this invention is for the position judging of portable apparatus to provide the radio equipment which becomes possible exactly finely.

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MEANS

[Means for Solving the Problem]Radio equipment by invention of the 1st of this application is portable apparatus which a user can carry, and body apparatus which performs radio between this portable apparatus radio equipment which it has, and said portable apparatus, When a signal for portable apparatus detection from said body apparatus is received, have a function which transmits a signal of receiving intensity data of the signal for portable apparatus detection to said body apparatus, and said body apparatus, Said signal for portable apparatus detection is transmitted, respectively from two or more body apparatus side antennas arranged at a different position, and it has the function to perform a position judging of said portable apparatus, based on receiving intensity data of said signal for portable apparatus detection for said every body apparatus side antenna which received from said portable apparatus.

[0009]In this 1st invention, from two or more body apparatus side antennas arranged at a different position, a signal for portable apparatus detection is transmitted, respectively, and a position judging of portable apparatus is performed based on each receiving intensity data by the side of portable apparatus of a signal for these portable apparatus detection. For this reason, even if portable apparatus is near the body apparatus side [one] antenna and receiving intensity patience of a signal for portable apparatus detection from that body apparatus side antenna carries out **** saturation, a position judging is attained by considerable fineness by change of receiving intensity of a signal for portable apparatus detection from other body apparatus side antennas. That is, a position judging fine and more exact than a case where the number of antennas is one is attained. For example, even when a delicate position of the inside and outside of vehicles in which body apparatus was carried has portable apparatus, a judgment in the car outside of portable apparatus becomes possible exactly. In judging a position of portable apparatus as a distance from the antenna with receiving intensity data in one antenna, Although an absolute position of portable apparatus is not known at all (it understands whether portable apparatus is approaching an antenna), if it is this invention, it is also possible to grasp an absolute position of portable apparatus and to detect a position change of portable apparatus continuously. A signal for a collation check when "a signal for portable apparatus detection" needs a collation check of being predetermined portable apparatus here. Although it functions also as (for example, a request signal which requires a reply of an answer signal which contains an authorization code in portable apparatus), it may be a signal separate from a signal for this collation check. If it is a signal separate from a signal for a collation check, a signal for a collation check of a transmission output of this signal for portable apparatus detection can be set as a separate more desirable value. If a code for a collation check is not contained in a signal for portable apparatus detection, even if it carries out multiple-times transmission of the signal for portable apparatus detection, for example for an exact position judging, there is an advantage which does not pose a crime prevention top problem.

[0010]Radio equipment by invention of the 2nd of this application, Are portable apparatus which a user can carry, and body apparatus which performs radio between this portable apparatus the radio equipment which it has, and said body apparatus, From two or more body apparatus side antennas arranged at a different position, have a function which transmits a signal for portable apparatus detection, respectively, and said portable apparatus, When a signal for portable apparatus detection from said body apparatus is received, respectively, a position judging of the portable apparatus concerned is performed based on receiving intensity data of said signal for portable apparatus detection for said every body apparatus side antenna, and it has a function which transmits a signal as a result of the position judging to said body apparatus. Based on each receiving intensity data of a signal for portable apparatus detection transmitted, respectively, a position judging of portable apparatus is performed from

two or more body apparatus side antennas with which this 2nd invention has also been arranged at a different position. For this reason, a position judging of exact fine portable apparatus is attained like the 1st invention. And in this case, since processing of a position judging of portable apparatus is performed by the portable apparatus side, processing by the side of body apparatus becomes easy.

[0011]Radio equipment by invention of the 3rd of this application, Are portable apparatus which a user can carry, and body apparatus which performs radio between this portable apparatus the radio equipment which it has, and said portable apparatus, Have a function which transmits a signal for portable apparatus detection, and said body apparatus, Two or more body apparatus side antennas arranged at a different position receive said signal for portable apparatus detection, respectively, and it has the function to perform a position judging of said portable apparatus, based on receiving intensity data of said portable apparatus detecting signal by each body apparatus side antenna. A signal for a collation check when it needs to be collation checked that "a signal for portable apparatus detection" here is predetermined portable apparatus. Although it functions also as (for example, an answer signal containing an authorization code transmitted to body apparatus from portable apparatus), it may be a signal separate from a signal for this collation check. A position judging of portable apparatus is performed based on each receiving intensity data of a signal for portable apparatus detection received with two or more body apparatus side antennas with which this 3rd invention has also been arranged at a different position. For this reason, a position judging of exact fine portable apparatus is too attained like the 1st invention. And in this case, since processing of a position judging of portable apparatus is performed by the body apparatus side, processing by the side of portable apparatus becomes easy. Since it is necessary to transmit neither a signal of two or more receiving intensity data, nor a signal of a position decision result from portable apparatus, there is an advantage by which a signal which should be transmitted to body apparatus from portable apparatus for a position judging of portable apparatus is simplified.

[0012]As a desirable mode of the 1st or the 2nd invention, Said body apparatus carries out [various] change of the setting out of size relation of a transmission output of said signal for portable apparatus detection from each body apparatus side antenna, It has a function which transmits said signal for portable apparatus detection, and said body apparatus or portable apparatus is good also as composition which performs a position judging of said portable apparatus based on said receiving intensity data obtained about each setting out. As a desirable mode of the 3rd invention, said body apparatus carries out [various] change of the setting out of size relation of receiving sensitivity of said signal for portable apparatus detection by each body apparatus side antenna, It is good also as composition which performs a position judging of said portable apparatus based on said receiving intensity data which has the function to receive said signal for portable apparatus detection, and was obtained about each setting out. If it does in this way, based on variegated receiving intensity data, a finer position judging or a highly precise position judging will be attained.

[0013]A position of said portable apparatus in an arrangement direction of an antenna where a position judging of portable apparatus makes said pair as a desirable mode of each invention (the 1st thru/or 3rd invention) with size relation of receiving intensity data between antennas which makes a pair among the body apparatus side antennas is judged. Since the above-mentioned position judging is performed based on a communication result (namely, size relation of receiving intensity) unrelated to a transmission output at the time of transmitting and receiving a signal for portable apparatus detection as it is this composition, or an absolute value change and dispersion of receiving sensitivity, without it is influenced by performance changes, such as a communication circuit of portable apparatus or body apparatus, and an antenna, dispersion of performance, etc. -- a position judging of always exact portable apparatus -- reliability -- it becomes it is high and possible. In order to avoid faults, such as saturation of receiving intensity data, for example, A transmission output at the time of transmitting and receiving a signal for portable apparatus detection, or an absolute value of receiving sensitivity, For example, it becomes possible easily to also make it change on the whole according to distance of portable apparatus and each antenna (if portable apparatus is in a long-distance position from each antenna, heighten a transmission output etc., and if portable apparatus is in each antenna at a position of a short distance, make a transmission output etc. low).

[0014]moreover -- as the desirable mode of each invention -- body apparatus -- a vehicle (for example, a car.) It is carried in a motorbike, a light plane, etc. and portable apparatus has body apparatus or/and portable apparatus besides a vehicle and in a vehicle based on a result of said position judging, Or a mode which judges that a user who carried portable apparatus got in into a vehicle, or that said

user got down from the inside of a vehicle may be sufficient. In this case, a vehicle inside-and-outside judging of portable apparatus and a getting-on-and-off judging of a user who carried portable apparatus become possible exactly.

[0015]A control machine which performs automatically control management for realizing predetermined operation of a controlled object in a vehicle after body apparatus in each invention was carried in a vehicle, performing radio between portable apparatus and carrying out the collation check of being predetermined portable apparatus (for example) It may be a mounted machine which constitutes the above-mentioned smart entry system. Here, a lock device which performs locking or unlocking of a door of a vehicle, or/and a mounted object (thing except said lock device) of a vehicle are contained in said controlled object, for example. A signal output which realizes a locking action or unlock operation of said lock device or/and a signal output to which operation of said mounted object is permitted, data setting operation, or a signal output which orders its operation of said mounted object is included in said control management, for example. There may be loading apparatus other than driving sources, such as an engine and a motor, such as the controls, such as drives, such as transmission, and a handle, or an audio system, a navigation system or an air-conditioner, in a mounted object of a vehicle. "Data setting operation to which operation of a mounted object is permitted" means internal processing, such as building a flag which permits operation of a mounted object, for example in information processing in body apparatus.

[0016]And when it is a control machine of a vehicle which body apparatus mentioned above and judges that a user who carried portable apparatus by said position judging got in into a vehicle, composition which changes a kind or a control content of a controlled object may be used. For example, in a smart entry system which has an immobilizer function mentioned above. It judges that a user who carried portable apparatus got in vehicles as mentioned already, Although it is desirable to change an authorization code transmitted and received and a transmission output from an object for the lock/unlock of a vehicle door to engine control, a position determining function of this invention may be applied to a getting-on-and-off judging of a user for such mode switching. In this case, the above-mentioned mode switching is carried out exactly and a quality smart entry system can be realized by extension.

[0017]If it judges that a user to whom body apparatus or/and portable apparatus carried portable apparatus by said position judging got in into a vehicle when it is a control machine of a vehicle which body apparatus mentioned above, A mode which changes a transmission output of radio for said collation check in the direction in which grasps (position range of portable apparatus whose communication to body apparatus is attained) decrease in number is desirable. With such a mode, it is avoided exactly that a signal which contains an authorization code for a collation check although a user who carried portable apparatus is in a vehicle is always broadly transmitted so that it may become ability ready for receiving also around a vehicle, and crime prevention nature (thing to an authorization code theft) falls unnecessarily. Prescribed distance especially grasp of radio for said collation check from a vehicle from a comparatively wide range for remote control including a position outside a vehicle which separated. Crime prevention nature to an authorization code theft can be improved to the maximum extent, a size of grasp always being made into necessary minimum, and securing high convenience, in being what is changed to a limited range limited in a vehicle (the neighborhood of a vehicle may be included).

[0018]There may also be a mode in which both a change of a controlled object etc. which were mentioned above, and a change of a transmission output of radio for a collation check are performed. For example, if it is judged that a user who carried portable apparatus by said position judging got in into a vehicle, while body apparatus will change said controlled object from said lock device to said mounted objects (engine etc.), Composition which changes a transmission output of radio for said collation check may be sufficient as body apparatus or/and portable apparatus so that it may become the limited range in which grasp of radio for said collation check was restricted in a vehicle. A change of the above-mentioned transmission output may follow only the portable apparatus side, may follow only the body apparatus side, and may follow both. A change of said transmission output can be performed by, for example, changing to a value of a transmission output beforehand set to nonvolatile memory etc. for every position range in which portable apparatus exists. Or when changing said transmission output (when load in particular of control management does not pose a problem), it may be made to adjust said transmission output to a necessary minimum value which can communicate preferably each time (in a column of an embodiment of the invention, an example of this output adjustment is explained in full

detail).

[0019]As a desirable mode in case body apparatus is what is carried in a vehicle, It is good to have composition provided with an antenna arranged at a time as a body apparatus side antenna in both at least one corner of the getting-on-and-off direction (a crew member aims to get on and off, and it is usually the cross direction right-angled to a direction of movement of a vehicle) in a vehicle. A vehicle inside-and-outside judging of portable apparatus and a judgment of a user's getting-on-and-off operation become possible exactly and easily with relative size relation of receiving intensity data between the body apparatus side antennas arranged to said both corners as it is such composition. For example, for every antenna, in a fixed case, if a transmission output and receiving sensitivity of a signal for portable apparatus detection are a value in which the above-mentioned receiving intensity data is almost equal about both antennas, Portable apparatus and a user can judge that it is in the middle position (center of the inside of a vehicle) of the getting-on-and-off direction, and when one side of the above-mentioned receiving intensity data is a little large, portable apparatus and a user can judge that it is in a position (usually near the door in a vehicle) of antenna slippage of one side of the getting-on-and-off direction. When one side of the above-mentioned receiving intensity data is remarkable and large in this case, portable apparatus and a user can judge that it is in a position (near the door outside a vehicle) besides a vehicle of one side of the getting-on-and-off direction. Therefore, a thing [be / it / that portable apparatus is in a vehicle] etc. which a user who carried portable apparatus got in a vehicle can be judged easily and exactly by a relative comparison of receiving intensity data.

[0020]

[Embodiment of the Invention]Hereafter, an embodiment of the invention is described based on a drawing.

(The example of the 1st gestalt) The example of the 1st gestalt is explained first. This example of a gestalt is an example which applied this invention to the radio equipment of the entry system of the 2 door type vehicles 1, and the engine control system (what has a function of an immobilizer) as showed drawing 1 (b). This device is provided with the following.

As shown in drawing 1 (a), it is the portable apparatus 10.

Body apparatus 20 carried in the vehicles 1.

The antenna 40 for adjustment for transmission output adjustment.

In drawing 1 (a), the numerals 28 and 29, The door opening closed sensor which detects the switching condition of the door of the right and left of the vehicles 1 is shown, and the numerals 31 show the door lock actuator which is a driving source of the door lock device of the vehicles 1, and the numerals 32 show the control unit of the engine control system of the vehicles 1. The above-mentioned door opening closed sensors 28 and 29 are sensors for forming the trigger (cause) of the position judging of portable apparatus, or a transmission output change (adjustment), as later mentioned in this case.

[0021]A receiving means (graphic display abbreviation) for the portable apparatus 10 to receive electric power (Wake rise signal) by the transfer of power of the noncontact type by electromagnetic waves, The portable apparatus side means of communication (what consists of an antenna or a transmission and reception circuit; graphic display abbreviation) for carrying out radio of the signal on different frequency for communication (for example, frequency in a UHF band) from the frequency (for example, 100-200 kHz) of said transfer of power, The received strength measurement means (graphic display abbreviation) which detects the field intensity of the signal received by this portable apparatus side means of communication, The control circuit (graphic display abbreviation) containing the microcomputer (henceforth a microcomputer) which realizes hold stores, such as control management of the whole portable apparatus, and an authorization code, An inside is equipped with an internal battery (graphic display abbreviation), the power supply circuit (graphic display abbreviation) which supplies the electric power of this internal battery to power consumption elements (said portable apparatus side means of communication, a control circuit, etc.), the control circuit (graphic display abbreviation) which performs power control in connection with transfer of power (reception of the Wake rise signal), etc. The switch 11 for locking and the switch 12 (refer to drawing 1 (b)) for unlocking which are the final controlling elements of a push button type are formed in the operation table side of this portable apparatus 10.

[0022]Here, the control circuit of the portable apparatus 10 has the nonvolatile portable apparatus side memory measure (for example, E²PROM; graphic display abbreviation) in which write-in elimination is possible as memory measures, such as an authorization code, for example. A control circuit is a circuit which performs control which changes a control circuit from what is called sleeping (power consumption is a zero state mostly) to a normal state (state which is not sleeping) by making into a trigger electric

power (Wake rise signal) received by the receiving means. The change to sleeping from the normal state of a control circuit is realized by a control circuit's own control management in this case. If the switch 11 for locking or the switch 12 for unlocking is operated, naturally a control circuit will shift to a normal state from sleeping if needed, and will receive this operation switch.

[0023]The above-mentioned control circuit of the portable apparatus 10 has the function to perform the following processing operation by operation program setting out of the microcomputer, etc., in a normal state. Namely, as shown in drawing 1 (b), on condition that the request signal by which wireless transmission is carried out from the body apparatus 20 during starting is received, it carries out, It has a function which carries out wireless transmission of the answer signal which contains the thing corresponding to the control mode at the time among two or more authorization codes (the object for door-lock control, engine start and the object for stop control, for output adjustments, etc.) beforehand registered into said portable apparatus side memory measure via the transmission and reception circuit 54. When said portable apparatus side means of communication receives the portable apparatus detecting signal transmitted from the body apparatus 20, It has a function which transmits the portable apparatus detection reply signal containing the receiving intensity data detected by said received strength measurement means, the antenna identification code (it mentions later) contained in the received portable apparatus detecting signal, etc. by said portable apparatus side means of communication (reply). According to the mode switching signal transmitted from the body apparatus 21, control mode is changed from door-lock control mode to engine start and stop control mode, and it has the function to perform output adjustment etc. (the detailed after-mentioned is carried out). Operation of the switch 11 for locking or the switch 12 for unlocking will also have a function which carries out wireless transmission of the locking command signal containing the authorization code for door-lock control, or the unlocking command signal containing the authorization code. If these locking command signal or an unlocking command signal is transmitted and these are received by the body apparatus 20, after a collation check is made by the control facility of the body apparatus 20, operation which locks or unlocks the door of the vehicles 1 will be performed. That is, the radio equipment of this example of a gestalt which consists of the portable apparatus 10 and the body apparatus 20 has the composition of also realizing the same function as the radio equipment (thing of the one-way-communication type mentioned above) of a common keyless entry system.

[0024]On the other hand, the body apparatus 20 is provided with the following.

As shown in drawing 1 (a), it is the control unit 21.

Vehicle indoor antennas 24 and 25.

In addition to the vehicle indoor antenna, it may be formed in vehicle outdoor instead of the antenna by the side of body apparatus being a vehicle indoor antenna. The vehicle indoor antennas 24 and 25 are formed in right-and-left both the corners (for example, on an instrument panel etc.) of the indoor front part of the vehicles 1 in this case. The antenna 40 for adjustment is formed in the indoor place by the window (a near pillar) of the vehicles 1 to this, for example. Although the vehicle indoor antennas 24 and 25 in this case are shared as an object for transmission and reception of a signal the object for the Wake rise signal transmission (for transfer of power), and usual (for the radio in said frequency for communication), For example, the antenna as an object for transmission and reception of the usual signal and the antenna for transfer of power may be formed separately.

[0025]The control unit 21 is provided with the control circuit 21a containing a microcomputer, the transmission and reception circuit 21b for sending out electric power by transfer of power, or carrying out radio of the signal on the frequency for communication, a power supply circuit, the timer circuit for intermittent starting (graphic display abbreviation), etc. Here, especially since this invention in particular is not limited but various publicly known composition can be adopted at least about the detailed composition of said transmission and reception circuit 21b, a power supply circuit, etc., it does not explain. The control circuit 21a is provided with a microcomputer, and has further the nonvolatile body apparatus side memory measure (for example, E²PROM; graphic display abbreviation) in which write-in elimination is possible as memory measures, such as an authorization code, for example. Power consumption is stopped by necessary minimum by starting this control circuit 21a intermittently with a given period by operation of said timer circuit.

[0026]The above-mentioned control circuit 21a has the function to perform the following processing operation, by operation program setting out of the microcomputer, etc. Namely, whenever it starts, for example by the above-mentioned timer circuit, as it is shown in drawing 1 (b), After sending out the predetermined power which serves as the Wake rise signal of the portable apparatus 10 by the

transmission and reception circuit 21b, If wireless transmission of the request signal which searches for an answer signal is carried out by the transmission and reception circuit 21b and the transmission and reception circuit 21b receives said answer signal from the portable apparatus 10 after transmission of this request signal, Noting that a collation check will be made, if it judges whether the authorization code contained in said answer signal supports the authorization code beforehand registered into said body apparatus side memory measure, and this decision result is affirmative, It has the function to perform predetermined control management according to the control mode at the time (the detailed after-mentioned is carried out). The control circuit 21a of the body apparatus 20 is predetermined timing (an example is mentioned later), and performs operation for the position judging of the portable apparatus 10.

[0027]Next, the operation and the principle of a position judging of the portable apparatus 10 in this radio equipment are explained. The position judging of the portable apparatus 10 in this example is performed as follows. First, the portable apparatus detecting signal which contains a respectively separate antenna identification code from either of each vehicle indoor antennas 24 and 25 is transmitted simultaneous or one by one by control of the control circuit 21a of the body apparatus 20, Repeat execution of the communication operation which receives said portable apparatus detection reply signal replied from the portable apparatus 10, respectively is carried out about three conditions (setups of a transmission output). Here, an antenna identification code is the information for identifying whether it is the signal transmitted from any of the antennas 24 and 25. When transmission strength from the antenna 25 of a drivers side (it expresses with the numerals D) is made three conditions with $Pt(D)$ as shown in drawing 2, and transmission strength from the antenna 24 of a passenger side (it expresses with the numerals A) is set to $Pt(A)$, They are the 1st condition used as $Pt(D) > Pt(A)$, the 2nd condition used as $Pt(D) = Pt(A)$, and the 3rd condition used as $Pt(D) < Pt(A)$. At drawing 2, it expresses that it is the 1st condition with the numerals D1 and A1, and expresses that it is the 2nd or 3rd condition with the numerals D2, A2 or D3, and A3 similarly.

[0028]Even if the size as an absolute value of the transmission output of a portable apparatus detecting signal has the portable apparatus 10 in in the car, the receiving intensity data should be set as the value which is not saturated if possible. It may be made for the position (***** [that it is in distance with each antennas 24 and 25 or in the car] etc.) of the portable apparatus 10 to adjust the absolute value of the transmission output of a portable apparatus detecting signal to a necessary minimum value preferably each time. It adds to the above-mentioned antenna identification code, and condition code is contained in the portable apparatus detecting signal. This condition code is the information for identifying whether it is the signal transmitted on which conditions among the three above-mentioned conditions. On the other hand in the above-mentioned communication operation, in the portable apparatus 10. Whenever it received the portable apparatus detecting signal which is separately transmitted from each antennas 24 and 25, and contains a separate antenna identification code, respectively, as it mentioned above, The portable apparatus detection reply signal containing the receiving intensity data (in this case, absolute value) of each portable apparatus detecting signal, the antenna identification code contained in the received portable apparatus detecting signal, and condition code is transmitted by said portable apparatus side means of communication (reply).

[0029]Then, a total of six receiving intensity data E obtained in this way in the control circuit 21a of the body apparatus 10 (D1). It is judged whether based on E (A1), E (D2), E (A2), E (D3), and E (A3), the portable apparatus 10 exists in which position range of two or more position ranges which can be set in the getting-on-and-off direction (cross direction of the vehicles 1) of the vehicles 1. In this case, as two or more of these position ranges (area), As shown in drawing 2 and drawing 3, the outside of the car of a drivers side, driver door slippage (Dd) (Dout), On drivers side driver's seat central (Dc) drivers side vehicles central slippage (Dcc) and Chuo Line of vehicles, (C), Passenger side vehicles central slippage (Acc), passenger side passenger seat central (Ac) passenger door slippage (Ad), Nine position ranges (Aout) outside the car of a passenger side are set up in the getting-on-and-off direction (cross direction) of the vehicles 1, and it has the composition that a desirable fine position judging is performed by the size relation of each receiving intensity data for the judgment in the car outside of the portable apparatus 10. Namely, if the portable apparatus 10 exists on Chuo Line of vehicles at (C) etc. in the case of the 1st condition ($Pt(D1) > Pt(A1)$), as shown, for example in drawing 2, the size relation of receiving intensity data, It is set to $E(D1) > E(A1)$, if it exists in the center of a passenger side passenger seat (Ac), it will be set to $E(D1) = E(A1)$, and it will be set to $E(D1) < E(A1)$ if it exists in passenger door slippage (Ad) etc. About other conditions, as shown in drawing 2, naturally the size

relation of the receiving intensity data about each antenna changes with the existence position ranges of the portable apparatus 10 in a similar manner. then -- if this size relation is classified into the five modes (1-5) as shown in drawing 4 (a) in this case -- about said three conditions in this mode -- combining (mode combination) -- each position range (area) will correspond to 1 to 1, as shown in drawing 4 (b). For this reason, if the mutual comparison of the six obtained receiving intensity data is carried out about a monograph affair, respectively and it asks for the above-mentioned mode combination, the position judging in which the portable apparatus 10 exists from the relation shown in drawing 4 (b) can judge uniquely.

[0030]Next, the example of operation as a system (an entry system and an immobilizer system) of this radio equipment is explained with the control processing contents of the portable apparatus 10 for it, or the body apparatus 20. Drawing 5 is a flow chart which shows the flow of operation of this radio equipment. First, it is judged by processing (processing of the control circuit 21a) of the body apparatus 20 whether control mode is door-lock control mode (Step S1). In the initial state, it is set as door-lock control mode. In [door-lock control mode is the control mode in the case of performing lock/unlock control (control as an entry system) of a door, and] this door-lock control mode, Transmission outputs, such as the transmission and reception circuit 21b of the portable apparatus 10 or the body apparatus 20, serve as a comparatively big initial value (value which realizes comparatively wide grasp for remote control) desirable to an entry system. And when the predetermined power used as the above-mentioned Wake rise signal is sent out from the body apparatus 20 in this door-lock control mode, If the portable apparatus 10 exists in the above-mentioned grasp for remote control and the portable apparatus 10 receives this Wake rise signal, the request signal which the control circuit of the portable apparatus 10 switches from sleeping to a normal state as mentioned above, and is transmitted from the body apparatus 20 after that will also be received by the portable apparatus 10. Then, the answer signal which contains the authorization code for door-lock control (lock/unlock ID code) by processing of the control circuit of the portable apparatus 10 responding to this request signal is transmitted from the portable apparatus 10 (Step S2). Or operation of the switch 11 for locking or the switch 12 for unlocking of the portable apparatus 10 will transmit the locking command signal containing the authorization code for door-lock control, or the unlocking command signal containing the authorization code by control of the control circuit of the portable apparatus 10 (Step S2). In this case, after transmitting the above-mentioned answer signal, a locking command signal, or an unlocking command signal, the control circuit of the portable apparatus 10 returns to sleeping by own control management, and saves power consumption.

[0031]Then, the answer signal, locking command signal, or unlocking command signal transmitted as mentioned above, If it is transmission out of grasp, and there is no failure of the abnormal drop of the transmission output of the portable apparatus 10, etc., naturally it will be received by the body apparatus 20, It is judged whether the control circuit 21a of the body apparatus 20 which received this answer signal carries out comparative collation of the authorization code for door-lock control memorized by the authorization code for door-lock control contained in the answer signal etc. which were received, and the body apparatus side memory measure, and is in agreement (Step S3). And if the collated result of the above-mentioned authorization code for door-lock control is in agreement, lock/unlock control of the door of the vehicles 1 according to a situation will be performed by control of the control circuit 21a. In this case, when a door specifically has receiving intensity data of the answer signal received, for example in a locked state above a default (when it is presumed that the user has approached the door of the locked vehicles), Or when the received signal is an unlocking command signal, the control signal output which orders the door lock actuator 31 unlock operation is performed. The receiving intensity data of the answer signal received, for example is less than a default (or). When a door is in an unlocked state by the case where it becomes impossible to receive from the state where the answer signal was able to be received (when it is presumed that the user separated from the door of the vehicles of an unlocked state), Or when the received signal is a locking command signal, the control signal output which orders the door lock actuator 31 a locking action is performed (step S4).

[0032]Subsequently, when the lock/unlock control performed by control of the control circuit 21a is a locking action (control signal output which orders it a locking action), a series of operations are ended and operation is repeated from the state of Step S1 (Step S5). When a locking action is performed in this way, When operation of a position judging of the above-mentioned portable apparatus 10 is performed just to make sure, for example and the portable apparatus 10 is in in the car before ending a series of processings, It is good also as composition which outputs an alarm (for example, thing to

depend on the operation of a horn, lighting of a light, etc.), or performs unlock operation compulsorily, and avoids a file of the portable apparatus 10 certainly. the time check of the timer with which the control circuit 21a of the body apparatus 20 was beforehand set up on the other hand when the lock/unlock control performed by control of the control circuit 21a was unlock operation (control signal output which orders it unlock operation) — operation is started (Step S6). About several minutes may be sufficient as the set period of this timer. And the control circuit 21a reads the detect output of the door opening closed sensors 28 and 29 after that, If it judges whether the door was able to open or not (Step S7) and what which door was able to open by the time the above-mentioned timer counted up (namely, until the set period of a timer passes since unlock operation) is not judged, Locking control (output of the control signal which orders it a locking action to the door lock actuator 31) is performed, and the door of the vehicles 1 is returned to a locked state (Step S8, S9). Although unlock operation was performed this, since the rear door cannot open, it is operation which is judged to have been unnecessary unlock operation and is automatically returned to a locked state from a viewpoint of crime prevention nature reservation.

[0033]If what the door was able to open by the time the above-mentioned timer counted up is judged, Operation of a position judging of the portable apparatus 10 mentioned above is performed (step S9a), and it is judged exactly whether based on this position decision result, the portable apparatus 10 entered in the empty vehicle outside a vehicle (step S9b). (did the user who carried the portable apparatus 10 get in into the vehicles 1 or not?) For example, when the position of the portable apparatus 10 changes from the area D_{out} mentioned above to D_d and changes to D_c further, it can judge with having entered in the empty vehicle outside a vehicle certainly. In this case, operation (transmission and reception of the portable apparatus detecting signal mentioned above or a portable apparatus detection reply signal, and processing of size comparison of receiving intensity data, etc.) of the above-mentioned position judging, Repeat execution is carried out until it is judged with the vehicle door which it was judged with the portable apparatus 10 having gone into in the car, or was once able to be opened having been closed (step S9b, S9c). When it is judged with the vehicle door having been closed before judging that the portable apparatus 10 went into in the car, it progresses to step S9 from a viewpoint on crime prevention, and returns to a locked state, and processing of an after that series is ended (step S9c, S9). When the door remains the portable apparatus's 10 having continued existing outside the car, and opening on the occasion of processing of step S9a and S9b, When a predetermined set period passes in the state which the portable apparatus 10 continues existing outside a car, and the door has opened since operation does not progress previously forever (since operation of a position judging will be repeated eternally) for example, it is processing of the control circuit 21a, What is necessary is just to have composition (with the following processing cycles, operation is again repeated from Step S1) which a series of processings end.

[0034]And when it judges that the portable apparatus 10 went into in the car. Since it is presumed that the user who carried the portable apparatus 10 got in into the vehicles 1, the control circuit 21a of the body apparatus 20, While transmitting the mode change reporting signal which reports a mode change after changing control mode to engine start and stop control mode and sending out the Wake rise signal again to the portable apparatus 10, Output switching of the transmission and reception circuit 21b is performed so that it may become a transmission output desirable in this engine start and stop control mode. And it switches from sleeping to a normal state by the above-mentioned Wake rise signal, Output switching of the transmission and reception circuit of the portable apparatus 10 is performed so that the control circuit of the portable apparatus 10 which received the above-mentioned mode change reporting signal may also become a transmission output desirable in this engine start and stop control mode (Step S10, S11). Output switching here is processing which only changes transmission outputs, such as the transmission and reception circuit 21b, into the comparatively small value (for example, value which realizes the vehicle interior of a room and the comparatively narrow communication range (limited range) only around the neighborhood) beforehand set to engine start and stop control modes from an initial value. It is necessary to necessarily change neither the transmission output of the signal for transfer of power (the Wake rise signal in namely, this case), nor the transmission output of the signal for a portable apparatus position judging (a portable apparatus detecting signal and a portable apparatus detection reply signal) among the transmission outputs of the body apparatus 20 or the portable apparatus 10. It is because it is not necessary to not necessarily include an authorization code which poses a crime prevention top problem in these signals. However, it may be made to adjust a transmission output in the reduction direction similarly about the transmission output of a portable apparatus detecting signal from

a viewpoint which avoids the saturation of receiving intensity data certainly. For example in front of Step S10 (after step S9b), by processing of the control circuit 21b by the side of the body apparatus 20. It may be made to end a series of operations without performing operation after Step S10, if operation which judges whether the door which was once able to be opened was again shut within the set period is performed and it is not again shut within a set period. Since it generally shuts after opening a door when the user A (shown in drawing 8) gets in into the vehicles 1, it is for making engine start and stop control possible, after checking it.

[0035]Next, as mentioned above, control mode is changed, and it is output adjustment (in this case). If a mere change is performed, the predetermined power used as the above-mentioned Wake rise signal will be again sent out from the body apparatus 20, and the control circuit of the portable apparatus 10 will switch from sleeping to a normal state. When the portable apparatus 10 receives the request signal transmitted from the body apparatus 20 after that, The answer signal which contains engine start and the authorization code for stop control (engine start and stop ID code) by processing of the control circuit of the portable apparatus 10 responding to this request signal is transmitted from the portable apparatus 10 (Step S12). In this case, the control circuit of the portable apparatus 10 returns to sleeping by own control management, for example, after transmitting the above-mentioned answer signal.

[0036]Then, the answer signal transmitted as mentioned above, The control circuit 21a of the body apparatus 20 which was naturally received by the body apparatus 20 when there was no failure of the abnormal drop of the transmission output of the portable apparatus 10, etc., and received this answer signal, Comparative collation of the engine start and the authorization code for stop control memorized by the engine start and the authorization code for stop control contained in the received answer signal, and the body apparatus side memory measure is carried out, and it is judged whether it is in agreement (Step S13). And if the collated result of above-mentioned engine start and authorization code for stop control is in agreement, The signal with which start up and a stop of an engine are permitted to the control unit 32 of an engine control system is outputted by control of the control circuit 21a, and it will be in the state where start up and a stop of an engine were permitted (Step S14). On the other hand, if the collated result is inharmonious, the signal which forbids start up and a stop of an engine to the control unit 32 of an engine control system will be outputted by control of the control circuit 21a, and it will be maintained by the state where start up and a stop of an engine were forbidden (Step S15).

[0037]If start up and a stop of an engine will be permitted, start up and a stop of an engine will be attained by the usual key operation (operation of an ignition key switch). Where start up and a stop of an engine are forbidden, start up and a stop of an engine become impossible only by the usual key operation. The state where start up and a stop of an engine were permitted by Step S14 here, When a door can open and it is shut after that, for example after an engine shutdown from a viewpoint of crime prevention nature reservation. (Namely, when it is presumed that the user got off) Or when judged with the portable apparatus 10 having come outside the car by the judgment of the below-mentioned step S18, it is automatically canceled by control of the control circuit 21a (that is, returned to the state where start up and a stop of an engine were forbidden) — it should constitute like.

[0038]Next, as mentioned above, after becoming engine start and stop control mode, It progresses to Step S16 in the judgment of Step S1 in the following processing cycles, It is judged whether the vehicle door operated (for example, could it open from the state where it closed or not?), In being in the state closed [the state which the vehicle door has opened, or] after becoming engine start and stop control mode, nothing is performed in this case but it completes a series of processings (that is, engine start and stop control mode are maintained). on the other hand, if the vehicle door in the state where it closed, for example can open after becoming engine start and stop control mode, and the vehicle door which remained opening is closed or, the above-mentioned position judging of the portable apparatus 10 will be again performed by making this into a trigger (Step S16, S17). And the portable apparatus 10 came outside the car as a result of this position judging (or). When judged with it being outside a car, the control circuit 21a of the body apparatus 20, While transmitting the mode change reporting signal which reports this mode change after changing control mode from engine start and stop control mode to door-lock control mode and sending out the Wake rise signal to the portable apparatus 10, Output switching of the transmission and reception circuit 21b is performed so that it may become a transmission output desirable to this door-lock control mode (Step S19, S20). And it switches from sleeping to a normal state by the above-mentioned Wake rise signal, Output switching of the transmission and reception circuit of the portable apparatus 10 is performed so that the control circuit of the portable apparatus 10

which received the above-mentioned mode change reporting signal may also become a transmission output desirable to this door-lock control mode (Step S19, S20). When not judged with the portable apparatus 10 having come outside the car as a result of the above-mentioned position judging, operation of a position judging (Step S17) is repeated (namely, when judged with the portable apparatus 10 being in in the car succeeding). The judgment of whether the portable apparatus 10 in Step S18 came outside the car should be judged more exactly as follows preferably. That is, when the position of the portable apparatus 10 changes from the area Dc mentioned above, for example to Dd and changes to Dout further, it can judge with having come outside the empty vehicle in the car certainly. When [of Step S17 and S18] the portable apparatus 10 is continuing existing in in the car in the case of processing, When a predetermined set period passes in the state where the portable apparatus 10 is continuing existing in in the car since operation does not progress previously forever (since operation of a position judging will be repeated forever) for example, it is processing of the control circuit 21a, a series of processings -- ending (operation is again repeated from Step S1) -- or Step S12 or subsequent ones should just have composition performed again.

[0039]Without according to the device of this example of a gestalt explained above, a user doing trouble key operation, as shown, for example in drawing 8, After unlocking the door of the vehicles 1 with which the lock/unlock of the door of the vehicles 1 is possible, and was moreover locked by remote control, it becomes handsfree and possible to obtain engine start-up / stop permission. Namely, even if the user A who carried the portable apparatus 10 is separated from the vehicles 1, If it is in said grasp for remote control, by the above-mentioned step S1 - the control action of S4. As shown in drawing 8 (a), automatic unlocking of the door of the vehicles 1 accompanied by the collation check by a smart entry function is performed, or the lock/unlock operation accompanied by the collation check of the door of the vehicles 1 by operation of the switch 11 for locking or the switch 12 for unlocking (in this case, operation needlessness) is attained. If the user A opens a door and gets in in the car as shown in drawing 8 (b) and (c) after the door of the vehicles 1 is unlocked, By the control action of the above-mentioned steps S7-S14, after entrainment operation of the user A by the position judging of the portable apparatus 10 is judged certainly, mode switching is performed, and the function (in this case, permission of start up and a stop of the engine accompanied by a collation check) as an immobilizer system is performed automatically.

[0040]And when the user A stops the vehicles 1, opens a door like drawing 9 (b) and gets down outside a car after operating the vehicles 1 as shown in drawing 9 (a), by the control action of the above-mentioned steps S16-S20. After alighting operation of the user A by the position judging of the portable apparatus 10 is judged certainly, mode switching is performed, and the function (in this case, automatic lock of the door of the vehicles 1 accompanied by a collation check) as Step S1 - a smart entry system by the control action of S4 is performed automatically again. That is, if it separates from the vehicles 1 as the user A who got down from the vehicles 1 shows drawing 10 (a) and (b), an automatic lock will be realized when communication stopped materializing, for example (at namely, the time of it having become impossible to receive said answer signal).

[0041]By the judgment in the car outside of the portable apparatus 10 in step S9a which mentioned above that the portable apparatus 10 was in in the car - S9b, Steps S17-S18, etc. When it is exactly grasped by the control circuit 21a of the body apparatus 20 and the portable apparatus 10 is in in the car, By the processing of Step S10 or Step S18 mentioned above, since control mode is always maintained by engine start and stop control mode, lock/unlock operation (step S4) of door-lock control mode is not performed certainly. For this reason, it is avoided certainly that it will be in the so-called state of a yne lock (file of the portable apparatus 10) by the locking action by door-lock control mode. If it processes outputting an alarm if position determining operation of the portable apparatus 10 is performed, for example after Step S5 and the comics **** portable apparatus 10 is in in the car just to make sure etc. when a locking action is performed by step S4 as mentioned above, a file of the portable apparatus 10 can be avoided more certainly. Although reference was not made in this example in particular about the case where the locking operation of a vehicle door is made by the usual mechanical key, Also in this case, position determining operation of the portable apparatus 10 is performed by control of the body apparatus 20, and if it processes outputting an alarm if the comics **** portable apparatus 10 is in in the car etc., the file trouble of the portable apparatus 10 by the usual key operation is also avoidable.

[0042]Furthermore, this device by the simple equipment configuration by which the means of communication of the lot was provided in the portable apparatus 10 and the body apparatus 20,

respectively. The function (a controlled object is a lock device of the vehicles 1) as an entry system which was mentioned above, Though it is the composition of having realized both functions (a controlled object is an engine control system of the vehicles 1) as an immobilizer system, The change (change of control mode in namely, this case) of the controlled object according to a situation, etc., The desirable grasp according to a controlled object etc. has realized the quality system (smart entry system which has a function of an immobilizer system) which could be realized exactly and always maintained the balance of crime prevention nature and convenience good. Namely, in control actions mentioned above, such as step S9a-S11 and Steps S17-S20, Based on the exact judgment (namely, the user's A judgment in the car outside) in the car outside of the portable apparatus 10, control mode (controlled object) is changed exactly and the change of a transmission output (that is, it responded to the controlled object) according to this control mode is performed further exactly. In this case, in the door-lock control mode which functions as an entry system. It is considered as a comparatively big transmission output (wide grasp), and is considered as a necessary minimum transmission output (narrow grasp) whose communication is attained mostly only indoors in the engine start and stop control mode which functions as an immobilizer system. For this reason, while each functions (the function of a smart entry or the function of an immobilizer) work exactly according to a situation, The transmission output (if it puts in another way grasp) of the portable apparatus 10 in the case of communication of the signal which contains an important authorization code on crime prevention, or the body apparatus 20 is exactly changed to the necessary minimum size which does not spoil convenience, and both convenience and crime prevention nature can always be maintained highly.

[0043]The signal for portable apparatus detection is transmitted, respectively from the body apparatus side antennas 24 and 25 of plurality (in this case, two pieces) arranged in this device at a different position, Based on each receiving intensity data by the side of the portable apparatus of the signal for these portable apparatus detection, as mentioned above, the position judging of the portable apparatus 10 is performed. For this reason, even if the portable apparatus 10 is near the body apparatus side [one] antenna 24 and receiving intensity patience of the signal for portable apparatus detection from that body apparatus side antenna 24 carries out **** saturation, Since the difference in the size relation of receiving intensity data which was mentioned above appears certainly by change of the receiving intensity of the signal for portable apparatus detection from other body apparatus side antennas 25, Even when the position judging with considerable fineness which was mentioned above becomes certainly possible, for example, the delicate position of the inside and outside of vehicles has the portable apparatus 10, the judgment in the car outside of the portable apparatus 10 becomes possible exactly. In judging the position of the portable apparatus 10 as a distance from the antenna with the receiving intensity data in one antenna, Although the absolute position of the portable apparatus 10 is not known (it understands whether the portable apparatus 10 is approaching the antenna), if it is the position judging art of this example, It is also possible for the absolute position of the getting-on-and-off direction (cross direction) of the vehicles 1 to become clear in this case by the explanation mentioned above in a clear passage, and to detect the position change of the portable apparatus 10 continuously. for this reason, the user who carried the portable apparatus 10 is going to get down from the vehicles 1 — or it becomes easy to judge to only move in the car etc. exactly, and the position of the portable apparatus 10 useful to highly efficient functional realization of a system which was mentioned already, and the information on an action are acquired correctly.

[0044]Since the portable apparatus detecting signal is transmitted and received in this example as a signal separate from especially the signal for a collation check (said request signal and an answer signal), the transmission output of this portable apparatus detecting signal, It is the position judging (in this case) of portable apparatus regardless of the transmission output of the signal for a collation check. Easily, it is possible to set it as a transmission output (for example, value with which it is lower than the transmission output of the request signal in door-lock control mode, and receiving intensity data is not saturated easily) mainly desirable to a vehicle indoor position judging, and by this, It can have composition in which the fault itself called the saturation of receiving intensity data which was mentioned above cannot get up easily. For this reason, the above-mentioned position judging is what has higher reliability also from such a point. In this example, the 1st condition — the 3rd condition of having mentioned above setting out of the size relation of the transmission output of the signal for portable apparatus detection from each body apparatus side antennas 24 and 25 are changed [various], It is the composition which transmits the signal for portable apparatus detection, and the body apparatus 20 is the composition of performing the position judging of the portable apparatus 10

based on the receiving intensity data (in this case, six data) of a large number obtained about each setting out (conditions). For this reason, based on variegated receiving intensity data, the finer position judging or the highly precise position judging is realized. Incidentally in this example, setting out of the size relation of the transmission output of the signal for portable apparatus detection from each body apparatus side antennas 24 and 25, For example, although it is good only also as the 1st above-mentioned condition (setting out with an equal transmission output of each antenna), in this case, For example, it was shown in drawing 2 or drawing 3, about the area Dd, Dc, Dcc and Ad, Ac, and Acc, it will be recognized as the same position range, and resolution (delicacy of a position judging) will fall and only that part can judge a motion of the vehicle indoor portable apparatus 10 finely in this case.

[0045] In this example, the position judging of the portable apparatus 10 judges the position of the portable apparatus 10 in the arrangement direction of the antennas 24 and 25 with the size relation of the mutual receiving intensity data of the body apparatus side antennas 24 and 25 which make a pair. For this reason, a communication result unrelated to the transmission output at the time of transmitting and receiving the signal for portable apparatus detection, or the absolute value change and dispersion of receiving sensitivity. since the above-mentioned position judging is performed based on (namely, the size relation of receiving intensity), without it is influenced by performance changes, such as a transmission and reception circuit of the portable apparatus 10 or the body apparatus 20, and an antenna, dispersion of performance, etc. — the position judging of the always exact portable apparatus 10 — reliability — it is high and possible. In order to avoid faults, such as saturation of receiving intensity data, for example, Changing the absolute value of the transmission output at the time of transmitting and receiving the signal for portable apparatus detection on the whole according to the distance of the portable apparatus 10 and each antennas 24 and 25 (for example, if the portable apparatus 10 is outside a car, heighten a transmission output, and if the portable apparatus 10 is in in the car, make a transmission output low) also has an advantage which becomes possible easily. In this example, it has composition which equipped both the corners of the getting-on-and-off direction (in this case, cross direction) in the vehicles 1 with the antennas 24 and 25 arranged an individual every as a body apparatus side antenna (getting it blocked, the arrangement direction of the antennas 24 and 25 is the getting-on-and-off direction of the vehicles 1). By for this reason, easy processing which compares the relative size relation of the receiving intensity data between each antenna as mentioned above. The whereabouts position of said getting-on-and-off direction of the portable apparatus 10 can judge exactly finely, and the judgment in the car outside of the portable apparatus 10 and the judgment of the user's A getting-on-and-off operation are exactly and easily possible by extension.

[0046] The (example of the 2nd gestalt), next the example of the 2nd gestalt are explained. This example of a gestalt carries out the partial change of the control management of drawing 5 in the example of the 1st gestalt. That is, output adjustment as shown in drawing 6 is performed when changing the output of Step S11 in drawing 5 each time, and the transmission output in engine start and stop control mode is set as each time more desirable value (that is, it adjusts). The art of output adjustment of explaining below may be applied when adjusting the transmission output of the portable apparatus detecting signal mentioned above (other examples of a gestalt mentioned later are the same). In this case, the control circuit of the portable apparatus 10 which received the above-mentioned mode change reporting signal, for example sets first the value of the parameter N for transmission output determination (integer) as "1" (Step S21), and sets the transmission output for adjustment of the transmission and reception circuit of the portable apparatus 10 as "KN" after that (Step S22). Here, "K" is an adjustment unit of a transmission output. Next, in the control circuit of the portable apparatus 10, a transmission output transmits the signal for adjustment in the state of KN (Step S23). Here, the signal for adjustment is a signal which requires the reply of the receiving reporting signal which reports that it can receive, and is good. [of that in which the authorization code (the authorization code for door-lock control, and engine start and the authorization code for stop control) for said collation check is not contained from a viewpoint on a crime prevention disposition] In this case, the authorization code (authorization code for adjustment) separate [for output adjustments] is contained in this signal for adjustment, and it can distinguish now from the signal for adjustment transmitted from other radio equipment of the same type. The body apparatus 20 via the antenna 40 (or the antennas 24 and 25 may be used) for adjustment, If this signal for adjustment is received, the authorization code for adjustment contained in this signal for adjustment will transmit the receiving reporting signal containing the authorization code for adjustment memorized by the body apparatus side memory measure on the assumption that it was in agreement with the authorization code for adjustment memorized by the body apparatus side memory measure by a

sufficiently big transmission output.

[0047]Subsequently, the control circuit of the portable apparatus 10 sets the value of the parameter N (integer) as "N+1" (Step S24), and judges whether the receiving reporting signal containing the predetermined authorization code for adjustment was received after that (Step S25). (that is, was the signal for adjustment received by the body apparatus 20 side or not?) And when a predetermined receiving reporting signal is not received, it returns to Step S22 and operation is repeated (that is, only the adjustment unit K makes a transmission output increase further, and transmits the signal for adjustment again, and the above-mentioned judgment is performed again). (namely, when the signal for adjustment is not received by the body apparatus 20 side) On the other hand, when a predetermined receiving reporting signal is received (namely, when the signal for adjustment is received by the body apparatus 20 side), In Step S26, in the case of the radio for a collation check at least. The transmission output of the transmission and reception circuit 21b in (namely, the case of Step S12 of the above-mentioned in this case) is set up in this case "K (N-1)" (that is, a transmission output is made to increase an adjustment unit every K, and it is set as the value which became ability ready for receiving at the beginning).

[0048]According to the above control action, the signal (signal which contains the authorization code for operating a controlled object at least) transmitted from the portable apparatus 10 side is set as a necessary minimum transmission output receivable (the antenna 40 for adjustment, or antennas 24 and 25) by the body apparatus 20 side at the time. For this reason, while not being set as the uniform transmission output (constant value set up beforehand) according to a controlled object, but depending according to a situation, being adjusted to the value of a desirable transmission output each time and securing the reliability of operation of a device highly, the effect that crime prevention nature is improved to the maximum is acquired. In this case, the answer signal (thing containing engine start and the authorization code for stop control) specifically transmitted from the portable apparatus 10 for the engine start and stop authorization control as an immobilizer system, While coming to be certainly received by the body apparatus 20, it is controlled finely that this answer signal is superfluously transmitted to the wide range, and crime prevention nature deteriorates (the grasp which can receive said answer signal is set as the necessary minimum finer range).

[0049]The body apparatus 20 side may also be made to perform the control action (adjustment of the transmission output in the case of the change of a transmission output) of drawing 6 explained above. Namely, the change (in this case, change in engine start and stop control mode) of control mode, The control circuit 21a judged by formation (in this case, thing which the judgment of Step S7 and S9b became affirmative) of the predetermined trigger, the signal for adjustment being first transmitted in the state of the transmission output KN ($N=1$), and it judging whether this was able to receive with the portable apparatus 10 (or -- passing the antenna 40 for adjustment), and, if unreceivable, What is necessary is to make N increase by "1" every, to repeat transmission of the signal for adjustment, and just to set the transmission output used by communication of Step S12 as the value of a transmission output when it is able to receive to the beginning in the place received first. The request signal which will be transmitted from the body apparatus 20 for the engine start and stop authorization control as an immobilizer system if it does in this way (by a case.) While coming to be certainly received by the portable apparatus 10, the thing containing the authorization code for a request for distinction with other devices, It is controlled finely that this request signal is superfluously transmitted to the wide range, and crime prevention nature deteriorates (the grasp which can receive said request signal is set as the necessary minimum finer range). When the above-mentioned transmission output adjustment is especially performed based on the communication propriety result of the signal for adjustment over the antenna 40 for adjustment, the grasp (namely, the ready-for-receiving ability range of the portable apparatus 10) of the signal transmitted to the portable apparatus 10 from the body apparatus 22 is set as the vehicle indoor last minute of the vehicles 1. for this reason, the function which communication of will certainly be attained and an immobilizer system will carry out if the portable apparatus 10 is in the vehicle interior of a room -- enough -- convenience -- it being able to utilize highly and, And since the signal (in this case, request signal) transmitted from the body apparatus 20 hardly leaks to vehicle outdoor, the crime prevention nature to the theft of a request signal increases to the maximum. Although it is not directly linked with the theft of vehicles, since an answer signal can be made to output from the portable apparatus 10 using this request signal now, the theft of a request signal has the desirable composition in which a request signal cannot carry out a theft easily from a viewpoint of securing high crime prevention nature, either.

[0050]The (example of the 3rd gestalt), next the example of the 3rd gestalt are explained. This example of a gestalt also carries out the partial change of the control management of drawing 5 in the example of the 1st gestalt. That is, output adjustment as shown in drawing 7 is performed when changing the output of Step S11 in drawing 5 each time, and the transmission output in engine start and stop control mode is set as each time more desirable value. In this case, the control circuit of the portable apparatus 10 which received the above-mentioned mode change reporting signal, for example sets first the value of the parameter N for transmission output determination (integer) as "10" (Step S31), and sets the transmission output for adjustment of the transmission and reception circuit of the portable apparatus 10 as "KN" after that (Step S32). Next, in the control circuit of the portable apparatus 10, a transmission output transmits the signal for adjustment in the state of KN (Step S33).

[0051]Subsequently, it is judged whether the control circuit 55 received the receiving reporting signal containing the predetermined authorization code for adjustment (Step S34). (that is, was the signal for adjustment received by the body apparatus 20 side or not?) And when a predetermined receiving reporting signal is received (namely, when the signal for adjustment is received by the body apparatus 20 side). The value of the parameter N (integer) is set as "N-2" (Step S35), it returns to Step S32 after that, and operation is repeated (that is, a transmission output is decreased by the twice of the adjustment unit K, the signal for adjustment is transmitted again, and the above-mentioned judgment is performed again). On the other hand, when a predetermined receiving reporting signal is not received (namely, when the signal for adjustment is not received by the body apparatus 20 side), In Step S36, in the case of the radio for a collation check at least. Temporary setting of the transmission output of the transmission and reception circuit 21b in (namely, the case of Step S12 of the above-mentioned in this case) is carried out to "K (N+1)" (that is, temporary setting is carried out to a value only with the bigger adjustment unit K than the value of the adjustment unit K decreased the transmission output every 2 times and it became impossible to receive first). Subsequently, the signal for adjustment is again transmitted by setting out of the transmission output by this step S36 (Step S37). And when the receiving reporting signal containing the predetermined authorization code for adjustment is received, the last setting out of the transmission output of the transmission and reception circuit 21b in the case of the radio for a collation check is carried out at least at "K (N+1)" (Step S38, S39). (namely, when the signal for adjustment for the second time is received by the body apparatus 20 side) On the other hand, when a predetermined receiving reporting signal is not received, the last setting out of the transmission output of the transmission and reception circuit 21b in the case of the radio for a collation check is carried out at least at "K (N+2)" (Step S38, S40). (namely, when the signal for adjustment for the second time is not received by the body apparatus 20 side)

[0052]The signal transmitted from the portable apparatus 10 side by the above control action at the time (at least) While setting the signal containing an authorization code as a necessary minimum transmission output receivable by the body apparatus 20 side, depending according to a situation, being adjusted to the value of a desirable transmission output and securing the reliability of operation of a device highly, the effect that crime prevention nature is improved to the maximum is acquired. Characteristic one enlarges variation width of a transmission output at first in this example of the 3rd gestalt (that is, in this case). 2 — when the communication to the beginning becomes making it change every [K] and impossible, radio for adjustment is performed again, and according to that result, the transmission output is finely tuned with still smaller variation width (in this case, K) (Steps S37-S40). For this reason, compared with the case (in the case like said example of the 2nd gestalt) where change a transmission output little by little and it is adjusted with the minimum variation width, there is an advantage in which time required for adjustment is short and lives. The body apparatus 20 side may be made to perform the control action (example of another of adjustment of the transmission output in the case of the change of a transmission output) of drawing 7 explained above similarly.

[0053](Other examples of a gestalt) In addition, this invention is not limited to the above-mentioned example of a gestalt, and may have various kinds of modification and a mode. First, in the above-mentioned example of a gestalt, as mentioned above, the relative comparison (size comparison) of the receiving intensity data of the portable apparatus detecting signal about each antennas 24 and 25 is performing the position judging of the portable apparatus 10, but it is also possible to perform a position judging based on the absolute value of these receiving intensity data. Namely, based on the absolute value of each receiving intensity data, the distance from each antennas 24 and 25 to the portable apparatus 10 is judged, The composition of judging the absolute value on the level surface of the portable apparatus 10 by pinpointing the position on the level surface by which these two distance

conditions are fulfilled (on a flat surface parallel to a road surface) on the basis of the position of each antennas 24 and 25 may be used.

[0054]In the above-mentioned example of a gestalt, as a portable apparatus detection reply signal replied from the portable apparatus 20, the value of receiving intensity data is considered as the composition which transmits the present state, and the position judging of the portable apparatus 10 based on the value of this receiving intensity data is processed by the body apparatus 10 side. However, comparison test processing (refer to drawing 2) of the size relation of the receiving intensity data mentioned above, for example, The data of the position decision result of the portable apparatus 10 based on [carry out by the portable apparatus 10 side and] this comparison test processing. The mode as which the portable apparatus 10 answers the portable apparatus detection reply signal containing (for example, the data of the mode connection shown in drawing 4 or the data in which the area itself in which the portable apparatus 10 is located is shown) to the body apparatus 20 may be sufficient.

[0055]The composition realized by the following processings may be used for the position judging of the portable apparatus 20. Corresponding [namely,] to the request signal for the portable apparatus detection from the body apparatus 20 for example, From the portable apparatus 10 side, have composition which transmits a portable apparatus detecting signal, and the body apparatus 20, The mode which receives said portable apparatus detecting signal from the portable apparatus 10, respectively, and performs the position judging of the portable apparatus 10 similarly based on the receiving intensity data of said portable apparatus detecting signal by each body apparatus side antennas 24 and 25 with the body apparatus side antennas 24 and 25 arranged at a different position may be sufficient. In this case, for example, it is made to transmit the signal for portable apparatus detection from the portable apparatus 10 3 times, They are three conditions (when the receiving sensitivity by each antenna is equal) about setting out of the receiving sensitivity by the body apparatus side antennas 24 and 25. By changing and receiving on three conditions when the receiving sensitivity by the antenna of another side is larger, when the receiving sensitivity by one antenna is larger. The operation effect (fine position judging) same with setting up the transmission output of the signal for portable apparatus detection on three conditions in said example of a gestalt is obtained.

[0056]Although the one-dimensional absolute position of the portable apparatus 10 is judged with two antennas in the above-mentioned example of a gestalt, Furthermore, many antennas are arranged in a different position, and if decision processing same about every two antennas of both that make a pair is performed, the judgment of a two-dimensional absolute position and a still finer position judging will be attained (for example, the position judging of the direction of movement of vehicles is also possible). In order to raise the resolution of a position judging, the conditions of the transmission output mentioned above or receiving sensitivity may be set up finely still in large numbers. Although the above-mentioned example of a gestalt showed the example for which the portable apparatus 10 or body apparatus 20 side also performs the change of a transmission output according to the change of the controlled object, the mode of which either one of the portable apparatus 10 side or the body apparatus 20 side smells, for example and which performs the change of a transmission output like a lever may be sufficient. Since the signal which incidentally includes the information on the most important authorization code in the case of the above-mentioned example of a gestalt is an answer signal transmitted from the portable apparatus 10 side, a practical effect is large even if it changes only the transmission output of the answer signal of the portable apparatus 10 by a controlled object. Although the signal (signal for adjustment) transmitted and received by the radio for adjustment shall contain the authorization code for adjustment in the above-mentioned example of a gestalt, it is good also as composition which does not perform the collation check from a viewpoint of the improvement in a process speed of output adjustment excluding such an authorization code, either.

[0057]Although the above-mentioned example of a gestalt showed the example which performs separately processing of the output adjustment shown in drawing 6, drawing 7, etc. by the portable apparatus 10 and body apparatus 20 side, For example, it may perform only by the body apparatus 20 side, the signal which reports the adjustment result may be transmitted to the portable apparatus 10, and the composition (for example, composition which does not transmit the signal for adjustment for output adjustment in the portable apparatus 10 side) that a transmission output is changed into the value according to the signal may be used in the portable apparatus 10 side. Although the composition which communicates by changing the control circuit of the portable apparatus 10 from sleeping to a normal state suitably with the Wake rise signal by transfer of power was illustrated in the above-mentioned example of a gestalt, the control circuit of the portable apparatus 10 may be the composition

only intermittently started by operation of a timer circuit (graphic display abbreviation). In this case, transmission of said Wake rise signal becomes unnecessary. This invention may not have a function of a common keyless entry system (in this case, the switches 11 and 12 are unnecessary).

[0058]Although the case where the number of controlled objects was two (the lock device and engine control system of a vehicle door) was illustrated in the above-mentioned example of a gestalt, further two or more controlled objects may exist. Although the trigger used as the cause which performs the position judging of the portable apparatus 10 and changes a controlled object and a transmission output is considered as the operation of the door in the above-mentioned example of a gestalt, it cannot be overemphasized that it is not restricted to this, either. For example, in making the lock device of a vehicle door, and engine start and a stop control system into a controlled object like the above-mentioned example of a gestalt. For example, when the doorknob sensor which detects that the hand etc. of the doorknob operation sensor which detects that the user operated the doorknob, or the user contacted or approached the doorknob is formed and these sensors output a detecting signal, As long as it is judged that performed the position judging of the portable apparatus 10 and the portable apparatus 10 went into in the car, it may be the composition that switch to engine start and stop control mode, and the change (change to the transmission output for start up and stop control modes) of a transmission output according to it is performed.

[0059]Although the above-mentioned example of a gestalt gave and explained the example in case the Wake rise signal (or request signal) is transmitted intermittently from the body apparatus side, It is good also as first composition for the Wake rise signal and a request signal to be transmitted from a viewpoint of cutting down the power consumption by the side of body apparatus, when a certain trigger is materialized. For example, when said doorknob operation sensor or a doorknob sensor outputs a detecting signal, the composition that the Wake rise signal (or request signal) is transmitted, and lock/unlock control is performed for the first time may be used. When position determining operation of the portable apparatus 10 is performed only when it is presumed in the above-mentioned example of a gestalt that the user is getting on and off to vehicles, a user gets in vehicles or it is judged with the user having got down from vehicles, Or when the predetermined set period expires, he is trying to suspend the position determining operation of the portable apparatus 10. However, it may be made to perform position determining operation of the portable apparatus 10 continuously for a long time. For example, from the time of the user who is carrying the portable apparatus 10 opening a door, and getting in in the car. Until an engine actually starts, or until the rear door is shut and a locking action is performed, Or repeat execution of the position determining operation is carried out continuously, the position of the portable apparatus 10 (namely, user) is grasped continuously, and it may be made to use for control of a system until the position of the portable apparatus 10 stops changing after that.

[0060]It is as description in the column of The means for solving a technical problem that this invention is restricted to neither unlocking or locking of a door, nor engine start up, but there may be various kinds of controlled objects and control contents. Even if it is the same controlled object, a control content and a transmission output may be changed according to the position decision result of portable apparatus. Further two or more switches may be formed in the portable apparatus 10, and it may have composition in which various kinds of remote control (manual operation) is possible corresponding to this. For example, the switch for operating opening and closing of a suitcase, an engine room or a refueling mouth, etc., etc. by remote control, when it is attacked by the rowdy, it cannot be overemphasized that the panic switch for blowing the horn of vehicles, etc. may be formed suitably. This invention is widely [besides the entry system of vehicles, etc.] applicable, if it is a device which performs a certain control based on the radio between portable apparatus and body apparatus.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a figure showing the entire configuration of radio equipment (smart entry system), etc.

[Drawing 2]It is a figure explaining the principle of a position judging of portable apparatus.

[Drawing 3]It is a figure showing the area of a position judging of portable apparatus.

[Drawing 4]It is a figure explaining the data of a position judging of portable apparatus.

[Drawing 5]Flow chart **** which shows the whole operation of radio equipment.

[Drawing 6]Flow chart **** which shows the adjusting operation of a transmission output.

[Drawing 7]Flow chart **** which shows the adjusting operation (example of another) of a transmission output.

[Drawing 8]It is a figure showing the example of use of radio equipment (at the time of entrainment).

[Drawing 9]It is a figure showing the example of use of radio equipment (at the time of alighting).

[Drawing 10]It is a figure showing the example of use of radio equipment (at the time of alighting).

[Description of Notations]

10 Portable apparatus

20 Body apparatus

21 Control unit

21a Control circuit

21b Transmission and reception circuit

24 25 Vehicle indoor antenna (body apparatus side antenna)

28, a 29 door-opening closed sensor

40 The antenna for adjustment

[Translation done.]

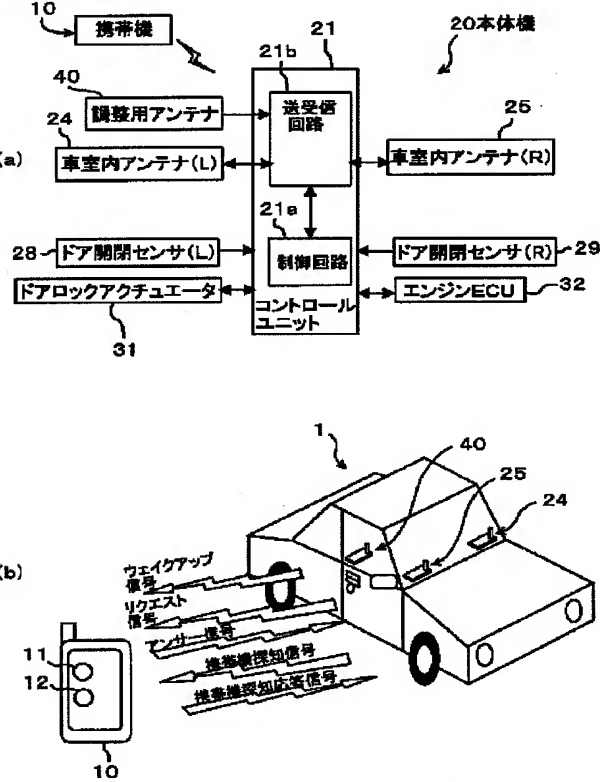
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DRAWINGS

[Drawing 1]



[Drawing 2]

| 携帯機の位置 | エリア | 二つのアンテナからの送信強度の関係 | | |
|---------|------------|-------------------|-----------------|-----------------|
| | | Pt(D1) > Pt(A1) | Pt(D2) = Pt(A2) | Pt(D3) < Pt(A3) |
| 運転席側の車外 | Dout | E(D1) >> E(A1) | E(D2) >> E(A2) | E(D3) > E(A3) |
| 運転席側 | Dd ドア寄り | E(D1) > E(A1) | E(D2) > E(A2) | E(D3) > E(A3) |
| | Do 運転席中央 | E(D1) > E(A1) | E(D2) > E(A2) | E(D3) = E(A3) |
| | Doo 車両中央寄り | E(D1) > E(A1) | E(D2) > E(A2) | E(D3) < E(A3) |
| 車両の中央線上 | C | E(D1) > E(A1) | E(D2) = E(A2) | E(D3) < E(A3) |
| 助手席側 | Aco 車両中央寄り | E(D1) > E(A1) | E(D2) < E(A2) | E(D3) < E(A3) |
| | Ac 助手席中央 | E(D1) = E(A1) | E(D2) < E(A2) | E(D3) < E(A3) |
| | Ad ドア寄り | E(D1) < E(A1) | E(D2) < E(A2) | E(D3) < E(A3) |
| 助手席側の車外 | Aout | E(D1) < E(A1) | E(D2) << E(A2) | E(D3) << E(A3) |

[Drawing 4]

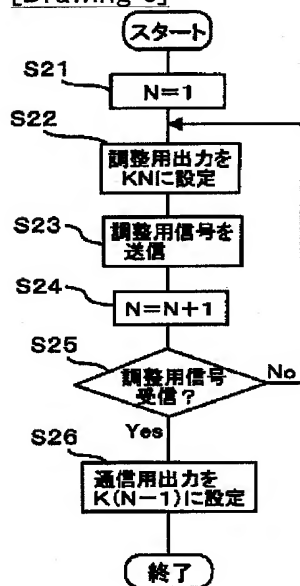
(a)

| MODE | |
|------|----------------|
| 1 | $E(D) >> E(A)$ |
| 2 | $E(D) > E(A)$ |
| 3 | $E(D) = E(A)$ |
| 4 | $E(D) < E(A)$ |
| 5 | $E(D) << E(A)$ |

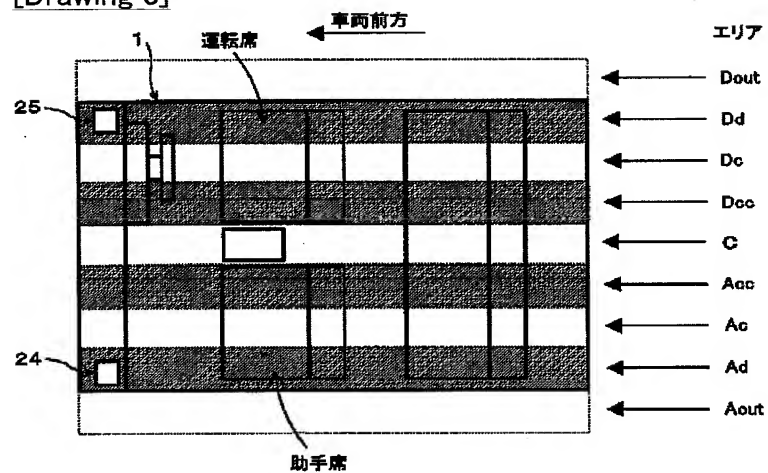
(b)

| エリア | MODE Combination |
|------|------------------|
| Dout | 112 |
| Dd | 222 |
| Dc | 223 |
| Dcc | 224 |
| C | 234 |
| Aac | 244 |
| Ac | 344 |
| Ad | 444 |
| Aout | 455 |

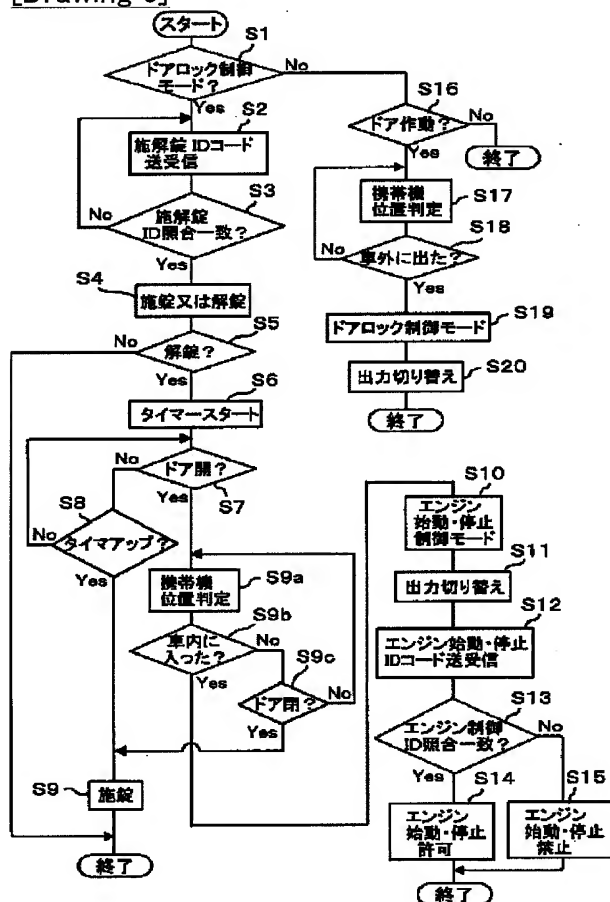
[Drawing 6]



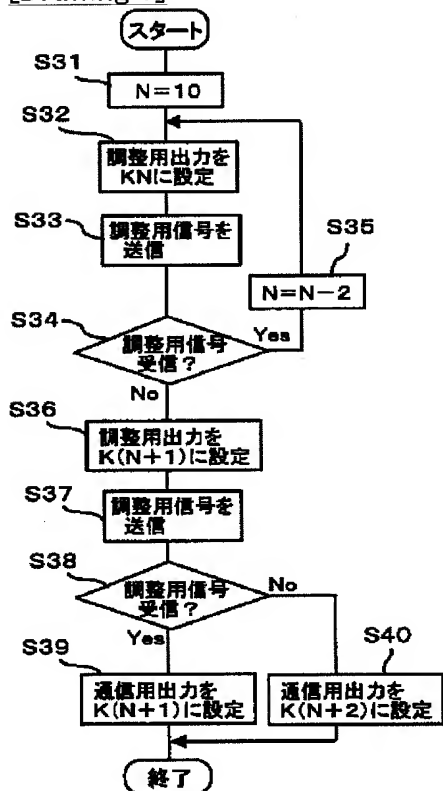
[Drawing 3]



[Drawing 5]



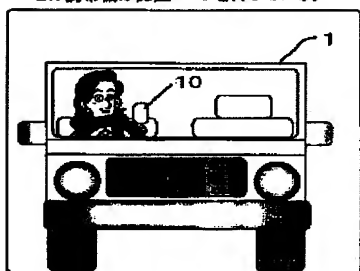
[Drawing 7]



[Drawing 9]

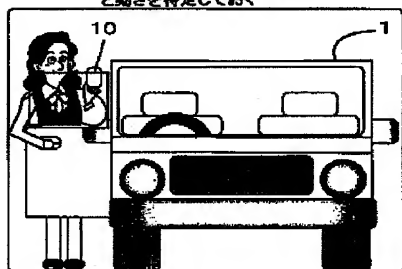
1. 車の利用者が携帯機を所持しており、
この携帯機は認証コードを持っている。

(a)



2. 携帯機をもって車から降りる。
この動作中に携帯機の位置
と動きを特定しておく

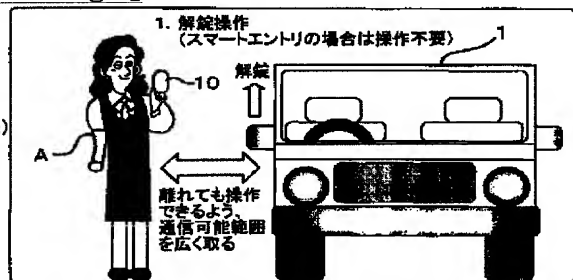
(b)



[Drawing 8]

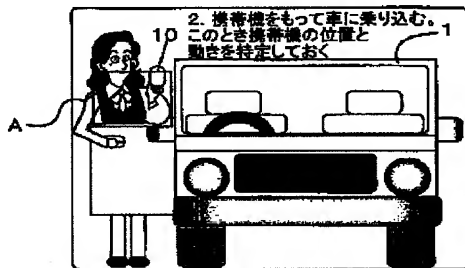
1. 解錠操作
(スマートエントリの場合は操作不要)

(a)



2. 携帯機をもって車に乗り込む。
このとき携帯機の位置と
動きを特定しておく

(b)



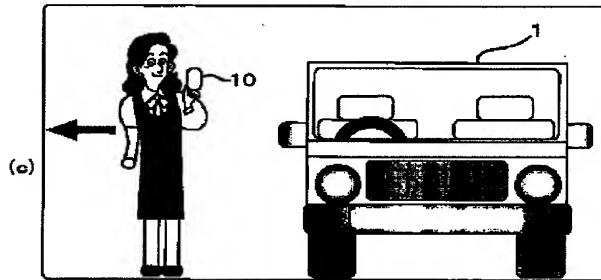
3. エンジン始動許可の認証を行う。
この認証のための通信可能範囲は、
必要最小限(車内だけ)が望ましい。

(c)

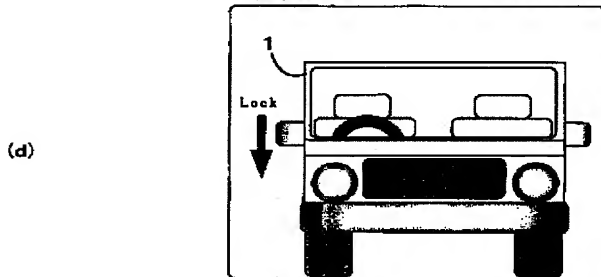


[Drawing 10]

3. 携帯電話を持ったまま車から離れる。
このとき、携帯電話の動きから車内
から車外へ出たことを検知している。



4. 携帯電話との通信が成立しなくなり、かつ
携帯電話が車内にないことを判別して施錠。



[Translation done.]